Biological Assessment

East Lake Sammamish Trail Master Plan

King County Facilities Management Division

King County

June 2007

Parametrix

Biological Assessment

East Lake Sammamish Trail Master Plan

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TABLE OF CONTENTS

EXECUTIVE SUMMARY VII

1. INTRODUCTION 1-1

1.1 PURPOSE AND NEED OF BIOLOGICAL ASSESSMENT 1-1

2. PROJECT LOCATION 2-1

3. PROJECT DESCRIPTION 3-1

3.1 PROJECT OVERVIEW 3-1

3.2 PROPOSED PROJECT CONSTRUCTION ACTIVITIES 3-4

3.2.1 Construction Sequence 3-5

3.2.2 Operational Activities 3-11

4. PROJECT VICINITY ENVIRONMENTAL CONDITIONS 4-1

4.1 ACTION AREA 4-1

4.2 AQUATIC RESOURCES 4-2

4.3 BEAR CREEK BASIN 4-2

4.4 SAMMAMISH RIVER BASIN 4-5

4.5 EAST LAKE SAMMAMISH BASIN 4-5

4.5.1 Panhandle Subbasin 4-5

4.5.2 Inglewood Subbasin 4-6

4.5.3 Monohon Subbasin 4-6

4.5.4 Thompson Subbasin 4-10

4.5.5 Pine Lake Subbasin 4-11

4.5.6 Laughing Jacobs Subbasin 4-11

4.6 LAKE SAMMAMISH 4-12

4.6.1 Issaquah Creek subbasin 4-12

4.7 BASELINE STREAM WATER QUALITY 4-13

4.8 WETLANDS 4-13

4.9 GEOGRAPHY AND SOILS 4-15

4.10 VEGETATION 4-18

4.11 WILDLIFE HABITAT 4-19

4.12 ENVIRONMENTAL BASELINE CONDITIONS 4-20

4.12.1 Terrestrial Species 4-20

4.12.2 Aquatic Species 4-20

5. EFFECTS OF PROJECT ON ENVIRONMENT 5-1

5.1 DIRECT EFFECTS 5-1

5.2 TERRESTRIAL NOISE 5-2

5.2.2 Effects on Water Quality 5-2

5.2.3 Effects on Wetlands and Wetland Buffers 5-5

5.2.4 Effects on Streams and Stream Buffers 5-6

TABLE OF CONTENTS (CONTINUED)

6. IMPACT AVOIDANCE AND MINIMIZATION MEASURES 6-1
6.1 WETLAND, STREAM, AND RIPARIAN BUFFER CONSERVATION MEASURES AND MITIGATION 6-1
6.2 BEST MANAGEMENT PRACTICES 6-2
7. FEDERALLY LISTED SPECIES IN THE ACTION AREA 7-1
7.1 CHINOOK SALMON 7-1
7.1.1 ESA and Stock Status 7-1
7.1.2 Occurrences of Chinook Salmon in the Project Area 7-2
7.1.3 Critical Habitat 7-2
7.2 BULL TROUT 7-3
7.2.1 ESA and Stock Status 7-3
7.2.2 Occurrences of Bull Trout in the Project Area 7-3
7.2.3 Critical Habitat 7-4
7.3 STEELHEAD 7-4
7.3.1 ESA and Stock Status 7-4
7.3.2 Occurrences of Steelhead in the Project Area 7-4
7.3.3 Critical Habitat 7-4
8. WILDLIFE SPECIES EVALUATIONS 8-1
8.1 BALD EAGLES 8-1
8.1.1 ESA Status and Distribution 8-1
8.1.2 Occurrences of Bald Eagles in the Project Area 8-1
8.1.3 Critical Habitat 8-2
9. EFFECTS DETERMINATIONS FOR LISTED SPECIES 9-1
9.1 EFFECTS ANALYSIS FOR CHINOOK SALMON 9-1
9.1.1 Direct Effects 9-1
9.1.2 Indirect Effects 9-2
9.1.3 Interrelated and Interdependent Activities 9-2
9.1.4 Effects Determination 9-3
9.2 CHINOOK SALMON CRITICAL HABITAT 9-3
9.3 EFFECTS ANALYSIS FOR BULL TROUT 9-3
9.3.1 Direct and Indirect Effects 9-3
9.3.2 Interrelated and Interdependent Activities 9-3
9.3.3 Effects Determination 9-4
9.4 BULL TROUT CRITICAL HABITAT 9-4
9.5 EFFECTS ANALYSIS FOR STEELHEAD 9-4
9.5.1 Direct and Indirect Effects 9-4
9.5.2 Interrelated and Interdependent Activities 9-4
9.5.3 Effects Determination 9-5
9.6 EFFECTS ANALYSIS FOR BALD EAGLES 9-5
9.6.1 Direct Effects 9-5

TABLE OF CONTENTS (CONTINUED)

9.6.2 Nesting Eagles 9-5
9.6.3 Indirect Effects 9-6
9.6.4 Interrelated and Interdependent Activities 9-6
9.6.5 Effects Determination 9-6

9.7 SUMMARY OF EFFECT DETERMINATIONS 9-7

10. REFERENCES 10-1

APPENDICES

A ESA Species Lists

B Proposed Project (Corridor Alternative) Alignment

C Construction Noise Analysis

D Project Area Photos

E Pathways and Indicators Discussion

F Cadmium, Lead, Chromium, and PAHs in Stormwater

G Listed Species Life Histories

H Essential Fish Habitat Consultation

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

1 ELST Master Plan Vicinity Map 2-3
2 Project Area Watersheds 2-5
3 Trail Cross-Section 3-3
4 East Lake Sammamish Trail Action Area 4-3
5 East Lake Sammamish Watershed 4-7

LIST OF TABLES

ES-1 Summary of Findings for Listed and Candidate Threatened and Endangered Species ix
1 Data and Data Sources for Information on Listed Species in the Vicinity of ELST Master Plan Project 1-1
2 Proposed Changes to Stream Culvert Crossing Conditions for the East Lake Sammamish Trail Project 3-10
3 Streams in the Panhandle Subbasin, East Lake Sammamish Basin 4-9
4 Streams in the Monohon Subbasin, East Lake Sammamish Basin 4-10
5 Summary of Category 5 Polluted Waters in the Project Area 4-13
6 Summary of Wetlands within the East Lake Sammamish Master Plan Trail Wetlands Study Area 4-14
7 Non-hydric Soils Mapped in the Vicinity of the Study Area 4-16
8 Hydric Soils Mapped in the Vicinity of Study Area. 4-17
9 Typical Plant and Wildlife Species Present in the Project Area 4-18
10 Checklist for Documenting Environmental Baseline and Effects of Proposed Action(s) on Relevant Indicators 4-21
11 Unavoidable Impacts to the Environmental Baseline and Offsetting Conservation Measures for the East Lake Sammamish Master Plan Trail Project 5-1
12 Riparian Buffer Impacts of the Trail Project on Fish-Bearing or Potentially Fish-Bearing Streams 5-7

ACRONYMS

BA	Biological Assessment
BFW	bankfull width
BMPs	best management practices
BNSF	Burlington Northern Santa Fe
cfs	cubic feet per second
CHSU	Critical Habitat Sub-unit
CMP	corrugated metal pipe
cy	cubic yards
DCE	Documented Categorical Exclusion
DDT	dichloro-diphenyl-trichloroethane
DPS	distinct population segment
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
EIS	environmental impact statement
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FHWA	Federal Highway Administration
GMA	Washington State Growth Management Act
HGM	Hydrogeomorphic (classification method)
HPA	WDFW Hydraulic Project Approval
HRM	WSDOT Highway Runoff Manual
HUC	hydrogeologic unit code
LWD	large woody debris
MP	milepost
MSE	mechanically stabilized earth
MSL	mean sea level
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
PAH	polycyclic aromatic hydrocarbon
PCE	primary constituent element
PGIS	pollutant generating impervious surface
PHS	Priority Habitats and Species
RM	river mile
SaSSI	state salmon and steelhead stock inventory

ACRONYMS (CONTINUED)

SR	State Route (Washington)
SWD	small woody debris
TDA	Threshold Discharge Area
TESC	temporary erosion and sediment control
TSS	total suspended solids
UGA	urban growth area
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WDF	Washington Department of Fisheries
WDFW	Washington State Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WRIA	Water Resources Inventory Area
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

King County Facilities Management Division (King County) proposes to implement the East Lake Sammamish Trail Master Plan. This involves improvements to the existing East Lake Sammamish Interim Use Trail. Improvements will include construction of a paved trail to accommodate pedestrian, wheeled, and equestrian uses, on paved and adjacent or separated soft surfaces. The Master Plan Trail (Trail) will be located within an existing railroad corridor. Federal funding is being provided by the Federal Highway Administration (FHWA) for the project, and permits are required from the U.S. Army Corps of Engineers, both actions creating a federal nexus for this project. The Endangered Species Act (ESA) requires federal agencies to ensure that their actions do not jeopardize the continued existence of threatened or endangered species or their critical habitats. On behalf of King County, Parametrix prepared this Biological Assessment (BA) to determine the potential effects of the proposed project on ESA-listed threatened and endangered species and their habitats. Analyses of potential effects were made based on a review of proposed project plans, on-site evaluation of existing habitat conditions, data on current and historical distributions of each species, and personal communications with local agency biologists.

The approximately 10.8-mile Trail extends from the about 200 feet west of Bear Creek in the City of Redmond, south to Gilman Boulevard in the City of Issaquah. The proposed project will widen and improve the existing trail to a width of 18 to 27 feet, which at its widest includes a 3-foot clear zone, 4-foot pedestrian/equestrian trail, 3-foot vegetated buffer, two 2-foot gravel shoulders, 12-foot paved trail, and 1-foot vegetated clear zone. This project will result in an increase of about 20 acres of total impervious surface, including three parking areas and two restroom facilities. However, the majority (18.8 acres) of this increase will be non-pollutant generating impervious surface (non-PGIS) area.

Fences and/or retaining walls are located adjacent to the existing trail, to protect sensitive areas. In a few instances, the separation between the paved trail and the pedestrian/equestrian trail will increase to take advantage of existing topography. In several locations safety and access will be improved by providing parking to those homeowners along the west side of the corridor with the Trail on the east side. The specific objectives of the project are to construct an alternative non-motorized transportation corridor and a multi-use recreational trail along the former Burlington-Northern Santa Fe railroad corridor, on the east side of Lake Sammamish.

Within the project or action areas, potentially affected ESA-listed fish species include Puget Sound Chinook salmon, bull trout, and steelhead. A single terrestrial wildlife species, bald eagle (currently being delisted), is also known to occur in the area, but there are no known listed plant species.

The primary waterbody within the action area is Lake Sammamish (Hydrologic Unit Codes 171100120202, 171100120401, and 171100120201), which contains populations of Chinook salmon, bull trout, and steelhead. The Action Area also includes 46 streams crossed by the project corridor. These streams include 9 streams known to support salmonids, 17 streams that could potentially support fish populations, and 20 unnamed streams with limited or no fish-bearing habitat. Chinook salmon and steelhead primarily occur in Bear and North Fork Issaquah creeks, but could occasionally occur in the lower reaches of several other streams in the project area. Bull trout are not expected to occur in the project area streams, but could occur in Lake Sammamish or lower Issaquah or Big Bear creeks on a seasonal basis. Fish habitat conditions within and adjacent to these streams vary substantially, from severely degraded to properly functioning.

Other fish species occurring in some of the action area streams, primarily include coho, sockeye, and kokanee salmon; rainbow and cutthroat trout; brook and river lamprey; and scattered occurrences of a variety of native and exotic game and non-game fish species (threespine stickleback, sculpins, smallmouth bass, speckled dace, long-nosed dace, northern pikeminnow, peamouth chub, and redside shiner).

Potential direct effects of the proposed project upon protected fish species include disturbance from in-water work activities, primarily the potential turbidity from lengthening, upgrading and replacing culverts. However, listed species are not known to occur in the streams where culvert or other in-water work will occur, so the potential effects will primarily be downstream in Lake Sammamish. To minimize effects on fish species, in-water work will occur during the summer in-water construction window established in the Hydraulic Project Application (HPA) permit. Other potential effects to fish and fish habitat that may result from the proposed project include riparian clearing, fill of wetlands, and discharge of treated stormwater into project area streams. Implementing appropriate project best management practices (BMPs), including sediment and erosion control measures, will reduce these potential impacts.

The proposed Trail construction also involves some activities potentially disturbing to bald eagles (e.g., riparian clearing and grading). Nesting and foraging bald eagles are known to occur in the project area. Although some trees large enough to be considered perch trees could be removed, no trees will be removed along the immediate shoreline of Lake Sammamish or Bear Creek, where foraging eagles are most likely to concentrate. Three bald eagle nests have been located within the action area in recent years, including 2005. These nest locations are all within about 0.2 mile of the Trail alignment. These nest sites are located at the north and south ends of the lake, and the mid-lake area near Pine Lake Creek. Activities that have the potential to create loud noises will be avoided within 0.5 mile of an active nest site during the bald eagle breeding season (January 1 through August 15), or a documented roosting site during the wintering period (October 31 through March 15). Activities subject to these seasonal restrictions will be upland pile driving, tree falling, and other construction activities expected to result in noise levels greater than about 70 A-weighted decibels (dBA) at an active nest or documented roosting site. Any potential impacts to foraging bald eagles and prey species will be insignificant and of temporary duration. Foraging habitat of equal quality exists along the shoreline of Lake Sammamish and on adjacent reaches of Bear Creek.

The National Oceanic and Atmospheric Administration Fisheries and the U.S. Fish and Wildlife Service have designated critical habitat for Puget Sound Chinook salmon evolutionarily significant unit (ESU) and the Coastal-Puget Sound bull trout distinct population segment (DPS), respectively. The closest critical habitat for both species is present in Lake Washington, about 13 miles downstream from the project site. Neither Lake Sammamish nor any of its tributaries contains designated critical habitat for either species.

A review of findings for each species is summarized in Table ES-1. In addition, the project will have no effect on Pacific salmon Essential Fish Habitat (EFH).

Table ES-1. Summary of Findings for Listed and Candidate Threatened and Endangered Species

Common Name Scientific Name	ESA Status	Life Stages Considered	Impacts Analysis Determination
Chinook salmon *Oncorhynchus tshawytscha*	Threatened	All freshwater phases	May affect, not likely to adversely affect
Bull trout *Salvelinus confluentus*	Threatened	All freshwater phases	May affect, not likely to adversely affect
Bald eagle *Haliaeetus leucocephalus*	Threatened[1]	All	May affect, not likely to adversely affect
Steelhead *O. mykiss*	Threatened	All freshwater phases	May affect, not likely to adversely affect

[1] USFWS has determined that bald eagles are no longer threatened, but the delisting process ongoing

1. INTRODUCTION

1.1 PURPOSE AND NEED OF BIOLOGICAL ASSESSMENT

The purpose of this Biological Assessment (BA) is to review the King County East Lake Sammamish Trail (Trail) Master Plan Project (project) in sufficient detail to determine if the proposed action may affect any threatened, endangered fisheries or wildlife species. Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions do not jeopardize listed species or their habitats. In this regard, federal actions include providing funding or issuing federal permits for a project. A BA is needed for this project because federal funding is involved, and federal permits are required. These actions constitute a federal nexus, therefore requiring Section 7 consultation among the Federal Highway Administration (FHWA), U.S. Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS). The Washington Department of Transportation (WSDOT) is the non-federal designee for the FHWA (federal action agency) responsible for preparing a BA consistent with the requirements set forth under Section 7 of the ESA (United States Code, 19 USC 1536 (c)).

This BA assesses the effects of the project on threaten and endangered species resources in the action area and documents appropriate minimization measures for the proposed action. Information on listed species and habitats occurring or potentially occurring in the project area was provided by state and federal agencies (Appendix A) and summarized in Table 1. NMFS and USFWS lists of threatened, endangered, and proposed species were downloaded from agency Web sites on February 9, 2007.

Table 1. Data and Data Sources for Information on Listed Species in the Vicinity of ELST Master Plan Project

Species and Habitats	Agency/Data Source	Data Provided
Endangered, threatened, rare, and sensitive plant species and high-quality plant communities	Washington State Department of Natural Resources (WDNR)	No such species or communities occur in the project vicinity.
Federally threatened and endangered plants, fish, and wildlife species	USFWS http://westernwashington.fws.gov/se/SE_List/KING.htm	Two threatened species could occur in the project vicinity: (1) Coastal Puget Sound bull trout (*Salvelinus confluentus*) DPS (2) Bald eagle (*Haliaeetus leucocephalus*)
Federally threatened and endangered fish species	NMFS http://www.nwr.noaa.gov/1salmon/salmesa/index.htm	Two threatened species could occur in the project vicinity: (1) Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) ESU (2) Puget Sound steelhead (*O. mykiss*) ESU
Critical habitat for federally threatened and endangered species	USFWS (2005) NMFS (2005)	The closest designated critical habitat for the Coastal Puget Sound bull trout DPS and Puget Sound Chinook salmon ESU occurs within Lake Washington, about 13 miles downstream of the project.
Priority Habitats and Species (PHS) (database search of January 18, 2007)	Washington State Department of Fish and Wildlife (WDFW)	Three bald eagle nest sites are located within about 0.25 mile of the project alignment. Bald eagles forage along Lake Sammamish and Big Bear Creek.

Currently, USFWS provides a species list based on listed species that are present within the county in which the project occurs. For the majority of the species identified for King County, either the species was not historically distributed within the action area and/or the action area does not contain suitable habitat to support the species. Therefore, the Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), grizzly bear (*Ursus a. horribilis*), marbled murrelet (*Brachyramphus marmoratus*), and northern spotted owl (*Strix occidentali*s) will not be addressed in this BA.

The USFWS county species list did not contain ESA-listed plant species. Information on threatened and endangered plant species and plant communities from the Washington State Department of Natural Resources (WDNR) Plant Natural Heritage Database indicated that no threatened or endangered plants are known to occur within the project vicinity.

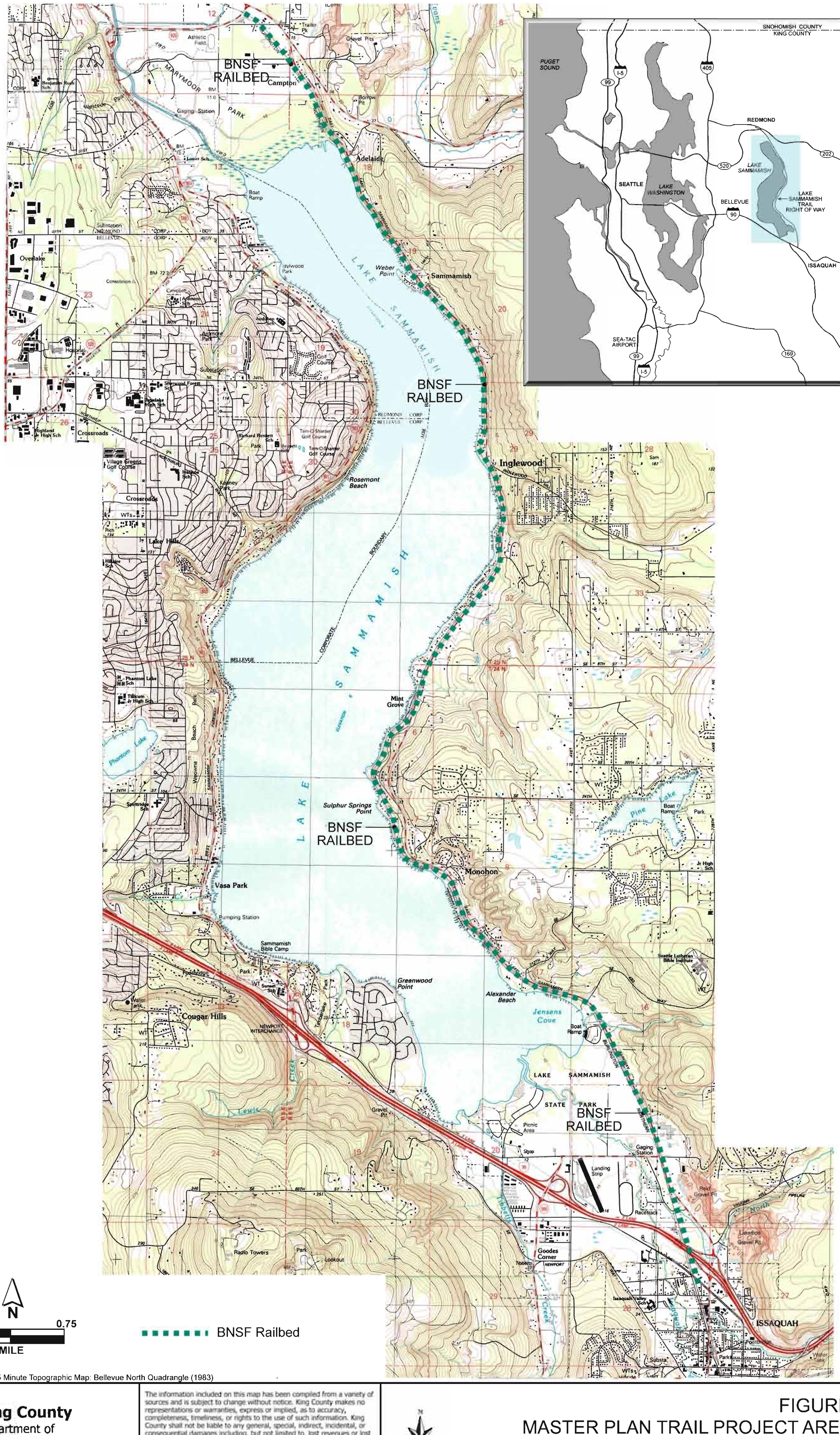
2. PROJECT LOCATION

The proposed project will construct about 10.8 miles of paved trail between Issaquah and Redmond, including portions of Sammamish and unincorporated King County (Figure 1). The project is located within Sections 18, 19, 20, 29, 31, and 32 of Township 25N, Range 06E and Sections 6, 7, 8, 16, and 17 of Township 24N, Range 06E. The majority of the project is located in 6th Field Hydrologic Unit Code (HUC) 171100120202, with a small part of the northern project edge in HUC 171100120401 and a small part of the southern project area in HUC 171100120201.

The project alignment roughly parallels the eastern shoreline of Lake Sammamish, and crosses 46 tributary streams that flow into the lake. All of the waterbodies potentially affected by the project are located in Water Resource Inventory Area (WRIA) 8–Lake Washington/Cedar/Sammamish Watershed. The Trail corridor crosses through five basins, including (from north to south) the Bear Creek, Sammamish River, East Lake Sammamish, Issaquah Creek, and North Fork Issaquah Creek basins (Figure 2). The East Lake Sammamish Basin, which encompasses the central portion of the project corridor, is divided into several smaller subbasins. The existing conditions of these basins and subbasins are provided in Section 4.

The East Lake Sammamish area is located on the eastern side of the Seattle metropolitan area and is rapidly urbanizing. The cities of Redmond and Issaquah were incorporated in 1912 and 1892, respectively (Issaquah was originally Gilman). Both cities have increased rapidly in population growth with both residential and business development. Both have annexed large areas in recent years and have plans for future annexations in their Urban Growth Areas. The City of Sammamish was incorporated in 1999 from lands that were formerly unincorporated King County. Numerous housing developments are proposed for all three cities.

The general boundaries of the East Lake Sammamish Trail Master Plan are Gilman Boulevard on the south and East Lake Sammamish Parkway SE on the east. Issaquah Creek and Lake Sammamish form the western project area boundary, near the southern end of the proposed Trail. At the northern end of the lake, the project boundaries consist of Marymoor Park and Redmond Way.



Source: USGS 7.5 Minute Topographic Map: Bellevue North Quadrangle (1983)

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SOURCES:

FIGURE 1
MASTER PLAN TRAIL PROJECT AREAS
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON

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SOURCES:

FIGURE 2
PROJECT AREA WATERSHEDS
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON

3. PROJECT DESCRIPTION

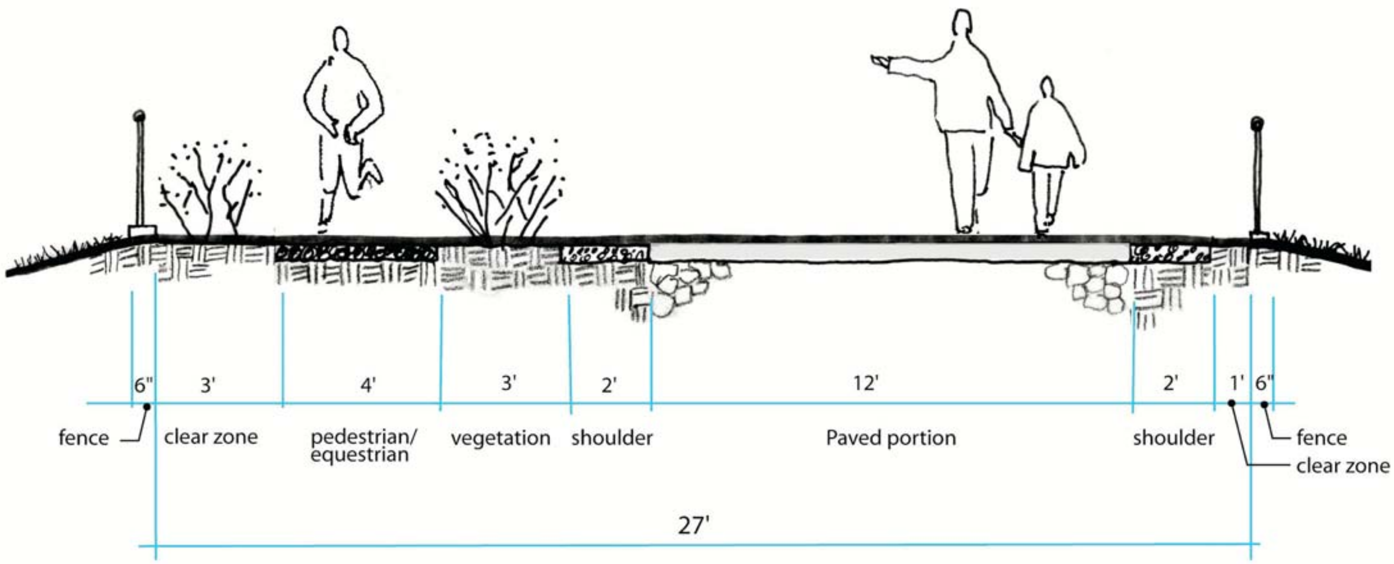
3.1 PROJECT OVERVIEW

The project will enhance an existing 10.8-mile Interim Use Trail along the former Burlington-Northern Santa Fe railroad right-of-way (see Figure 1). This project will replace the existing unpaved Interim Use Trail with a permanent paved, non-motorized, multi-use, recreational trail. The new Trail will accommodate pedestrian, wheeled, and equestrian uses on paved and adjacent or separated soft surfaces. The proposed project will widen and improve the existing Interim Use Trail to a width of 18 to 27 feet, which at its widest includes a 3-foot clear zone, 4-foot pedestrian/equestrian trail, 3-foot vegetated buffer, two 2-foot gravel shoulders, 12-foot paved trail, and 1-foot vegetated clear zone (Figure 3). The construction process will also include lengthening or replacing a number of existing culverts currently crossing the Trail corridor, as well as minor upgrades to previously constructed bridges over several of the larger tributaries. The project also includes constructing three parking areas and restrooms for Trail users, and the installation of fences and/or retaining walls to limit impacts to sensitive areas during construction and operation of the Trail.

This project will pave the existing 8- to 12-foot wide gravel trail, resulting in an increase of about 20 acres of total impervious surface, including three parking areas and two restroom facilities. However the majority (18.8 acres) of this increase will be non-pollutant generating impervious surface (non-PGIS) area. In a few instances, the separation between the paved trail and the pedestrian/equestrian trail will increase to take advantage of existing topography, and the proposed Trail will narrow to as little as about 18 feet in some areas to avoid existing structures, preserve access to adjacent properties, avoid and minimize impacts to sensitive areas, and increase safety at vehicle crossings. The narrowing will be accomplished by combining uses and/or eliminating Trail buffers; however, the paved portion will remain 12 feet wide, with 2-foot shoulders on either side.

Trail construction activities could result in temporary impacts on streams. These potential impacts include instream sedimentation resulting from erosion and runoff; disturbance of fish due to instream work, stream diversions, and dewatering activities; changes in stream hydrology; spills of hazardous materials (e.g., oil and gasoline); displacement of spawning fish by construction noise; and disturbance or removal of riparian vegetation. These types of impacts are discussed in detail below.

To accommodate the new Trail width, culverts on 18 streams will require modification (primarily lengthening) or replacement. Culverts on fish-bearing, or potentially fish-bearing streams will be replaced with fully fish passable structures, as necessary. However, none of these culvert replacement streams are known to support ESA-listed fish species. The four streams in the project area, known or suspected of supporting any ESA-listed species are currently spanned by bridges or fishpassable culverts. These culverts will not be modified as part of this project, and only minor modifications to these bridges (i.e., handrail or decking replacement) will occur, as necessary. Construction staging areas will occur at the three proposed parking area locations and at the two proposed restroom facilities, to minimize the amount of disturbed area in the action area.



SECTION A
NO SCALE

Corridor and East Alternatives

LEGEND

EXISTING SOIL OR FILL MATERIAL

PROPOSED GRAVEL

PAVEMENT

Notes

This section applies to the East Alternatives where they occur on the railbed.
Fences, guardrails, and retaining walls are shown in all illustrations, however these will be installed where needed but not in all locations.

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SOURCES:

FIGURE 3
TRAIL, CROSS SECTION
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON

3.2 PROPOSED PROJECT CONSTRUCTION ACTIVITIES

Trail construction is tentatively scheduled to begin as early as 2009 and completed in stages over several years. Due to the length of the project corridor, the construction will be phased by segments, and will occur over at least three construction seasons (not necessarily consecutively). Trail construction will likely begin at one or both ends and progress toward the center. However, the actual order in which Trail construction will occur in the various segments is not known at this time, and will be governed in part by timing restrictions identified in this report, environmental permits, and funding availability. For example, in-water construction work will only occur within the permitted in-water work window, and loud noise-generating construction equipment (pile drivers and chainsaws) will not be used within 0.5 mile of an active eagle nest during the nesting season (January 1 to August 15), or a documented roost site during the wintering period (October 31 to March 15). These permitting constraints could result in all these restricted activities (i.e., in-water work) occurring during a single permit period, or spread out over several permit periods. Construction activities unlikely to affect the ESA-listed species or their habitat will occur during sensitive seasons. Alternatively, the Trail could be completed in one segment before proceeding to another segment.

Despite the uncertainty regarding the schedule for specific portions of the Trail, impacts associated with general construction practices will be similar along the entire trail length, and all construction activities will be temporary. The existing trail was previously surfaced and graded with 5/8 inch minus gravel (approximately 4 inches deep), which provides a solid base for the proposed paving step. The width of the existing trail is also similar to the proposed paved trail area.

Culvert replacement and other work within the ordinary high water mark of the project area streams will occur in the dry, as the streams will be diverted (piped) around the construction areas. Retaining walls will be constructed to minimize the amount of fill required adjacent to streams and wetlands. Ditch and culvert maintenance, which may occur during the construction or operational phases of the Trail, could require localized vegetation removal as needed to access the site and manual cleaning of ditches and culverts using shovels and specialized tools, potentially resulting in short-term water quality impacts. Impacts are expected to be minor and isolated.

Vegetation removal will also occur along either side of the existing trail, to accommodate the enlarged trail width, although most of this cleared area will consist of the new unpaved trail area or as maintained trail buffer zone. These buffer areas will be periodically mowed or cut back during the continued operation of the Trail. Appropriate fill material (primarily gravel ballast) will be imported to form the new Trail areas, where needed. After final grading, the proposed paved portion of the Trail will be completed.

No treatment or detention facilities are proposed to handle the stormwater runoff from the completed Trail. The Trail is considered a non-PGIS, so treatment is not necessary. In addition, it is assumed that the dispersion of runoff to adjacent vegetated areas and existing lateral ditches and streams, will be insignificant due to the relatively small increase in impervious surface area in any one drainage basin along the corridor. However, treatment and detention facilities are proposed to manage the stormwater runoff from the proposed parking and restroom areas.

3.2.1 Construction Sequence

The following is a general description of the types of construction methods and the likely construction sequence for any segment of the project. The general steps in the construction sequence for the Trail will occur as follows:

1. Installation of best management practices (BMPs)
2. Preparation and demolition (of existing fences and footings, if needed)
3. Runoff and erosion control (temporary erosion and sediment control [TESC] plan implementation)
4. Vegetation clearing and grading, and retaining wall construction
5. Drainage system improvements
6. Stream crossing structures (extending or replacing culverts, including stream diversion, excavation, and backfilling)
7. Revegetation of temporary disturbed areas
8. Surfacing (the placement of asphalt, top course, base course, and top soil)
9. Fencing
10. Signage
11. Removing BMPs and implement final vegetation planting

Construction activities expected to generate the most noise will be tree cutting, asphalt cutting in conjunction with crossing driveways and access roads; excavation and grading; and audio warnings on vehicles backing up. A detailed discussion of the specific work elements with the greatest potential to affect listed species follows.

3.2.1.1 Clearing and Grading Activities

Clearing and grading, particularly in locations adjacent to streams and wetlands could temporarily increase turbidity in site runoff. These impacts will likely be caused by the erosion of disturbed soil areas or soil stockpiles and stormwater runoff transporting silt and sediment to receiving water bodies. Sediment and other contaminants can increase turbidity and affect other water-quality parameters such as the amount of oxygen available in the water. Impacts associated with spills are most likely to occur at staging areas. Stormwater runoff may also carry other contaminants, such as fuel and oil from construction equipment, particularly at staging areas (King County 2004b). Potential impacts to groundwater quality are not likely to occur as a result of the limited clearing and grading associated with the Trail projects or the dispersion of runoff from the Trail to adjacent vegetated buffer areas (King County 2004a, Appendix B).

The implementation and adherence to project BMPs will reduce the risk of erosion, and minimize the chance that sediments, chemical contaminants, nutrients, and other materials will enter waters in the project area during construction. Otherwise, the introduction of fine sediments through erosion and runoff to the streams can reduce the suitability of spawning gravels. These effects are usually greatest in stream reaches inhabited by salmonids during critical spawning and rearing periods where blankets of fine sediment can diminish the abundance and diversity of invertebrates that live in the stream bottom and provide a food source for fish. Sedimentation can also reduce spawning habitat suitability for fish spawning, unless fall and winter flows clear away the newly introduced sediments.

Within the project corridor, sedimentation at stream crossings could potentially be caused by (1) the construction of new culvert or bridge crossings and culvert extensions that will require dewatering; (2) laying of the base trail surface prior to final trail surfacing; and (3) hole excavation for fencing, signposts, and bollards.

To minimize the potential effects of erosion and construction site runoff from affecting surface water bodies in the area, a TESC plan will be prepared and implemented prior to any clearing or grading activities in the area. The TESC plan will establish specific BMPs, consistent with critical area codes and grading regulations of local jurisdictions. These BMPs will include various procedures to minimize and control erosion and runoff from project area construction sites (see Section 7.2).

3.2.1.2 Disturbance of Riparian Vegetation

Some riparian areas, on streams crossed by the Trail project, will be temporarily disturbed in the project area. These riparian areas are typically dominated by herbs and shrubs that provide limited riparian functions such as stream shading and woody debris. Where there are temporary disturbances or where riparian vegetation is removed (such as the areas immediately adjacent to the Trail fill slope), the disturbed area will be replanted with native vegetation, including shrubs and trees.

Permanent riparian buffer impacts are defined as the portion of the riparian buffer habitat permanently cleared of vegetation in order to accommodate the widened trail. The width of the buffer is defined by the critical areas ordinance of the applicable local jurisdiction. The total area of buffer impacts along the entire Trail alignment will be approximately 130,671 square feet (or 3.00 acres). Areas that are classified as wetland or as wetland buffer are not included in the totals of impacted riparian buffers because these areas will receive mitigation based on wetland regulations. Of the total area of impacted riparian buffer, 106,244 square feet (or 1.91 acres) occur along known or potential fish-bearing streams, and 24,428 square feet (or 0.53 acres) occur along non-fish-bearing streams. Areas of impacts to the buffers of individual streams range from under 10 square feet to over 19,000 square feet.

Of the 34 streams with stream riparian buffer impacts, 15 will experience impacts to less than 2,500 square feet (or 0.06 acre). Of the remaining streams, the largest buffer impacts typically occur where a stream flows parallel to the project corridor for some portion of its length (e.g., Stream 0143H). The existing riparian conditions along the streams vary, but most of these riparian buffers are already moderately to severely degraded. However, all reasonable efforts will be made to limit the extent of the vegetation clearing.

Although clearing vegetation along streams will result in the loss of some instream cover, other riparian functions such as providing large woody debris to the stream, contributing organic material to the stream, and regulating stream temperatures through shading will not be substantially affected because of the generally limited extent of clearing activities expected to occur immediately adjacent to streams. In cases where impacts to riparian vegetation in the stream buffers will be large or will affect trees or large shrubs that provide substantial shading, mitigation will occur where feasible. For example, it is not feasible to plant mature trees to replace trees removed during construction. In addition, other shade-producing riparian vegetation, removed to accommodate the width of the Trail, might be replanted with non-shade producing native species (i.e., grasses and sedges) that are more appropriate for continued maintenance activities of the Trail.

3.2.1.3 Construction of Ancillary Facilities

The project includes associated ancillary facilities: crosswalks, sidewalks, curbs, and gutters, as well as three parking areas and two restroom facilities. Only the parking facilities will create new pollutant-generating impervious surface (PGIS) area that could have potential for recurring water quality impacts. It is well documented that PGIS runoff, particularly in urban environments, contains pollutants that can impact the water quality of the receiving water. Pollutant loads in stormwater runoff vary depending on the amount and type of PGIS, traffic volume, duration and intensity of a storm event, time of year, antecedent weather condition, and several other factors, making it difficult to accurately determine pollutant loading (Driscoll et al. 1990). However, pollutant loading is correlated to the PGIS area, and the project will result in about 1.2 acres of PGIS from the construction of parking areas in support of the Trail.

The proposed project will provide water detention and water quality treatment facilities for 100 percent of the new PGIS area associated with the parking and restroom sites, to meet all applicable water quality standards for the long-term operation and maintenance of these facilities where discharge occurs directly to a fish-bearing stream or Lake Sammamish. Non-traditional stormwater techniques such as the use of permeable pavers, and bioretention swales will be considered for stormwater management at these sites.

The streams located near these ancillary facilities are all non-fish-bearing streams. The closest fish-bearing or potentially fish-bearing stream to these facilities is about 0.25 mile away. Therefore, construction of the facilities is not expected to result in direct physical impacts (such as fill or channel relocation) to any fish-bearing stream within the Trail corridor. Furthermore, appropriate BMPs will be implemented during construction to maintain water quality and minimize sedimentation in any other drainage feature adjacent to these facilities. For these reasons, construction of these facilities is not expected to negatively affect water quality, fish species, or aquatic habitats.

3.2.1.4 Retaining Wall Construction

Retaining walls will be required along some segments of the project to minimize the Trail footprint and reduce the impacts of fill on sensitive areas. However, retaining wall construction could have temporary indirect impacts on streams. Excavating to reach soil of sufficient bearing strength to support a retaining wall may require temporarily disturbing stream channels and dewatering the construction areas. Dewatering and stream diversions could lead to fish stranding or temporary barriers to fish migration. Minimizing the potential impacts of retaining wall construction will include choosing the most appropriate type of wall, designing the wall for site-specific conditions, and implementing appropriate BMPs (see Section 7.2). No in-water pile driving will occur for construction of retaining walls on fish-bearing or potential fish-bearing streams. Potential impacts to streams known or suspected of supporting Chinook salmon, steelhead, or bull trout will be minimized, as only minor upland modifications are planned for the bridges crossing these streams. No modifications will occur to the structural components of these bridges, particularly the retaining wall approaches occurring within the ordinary high water mark (OHWM) of these streams.

3.2.1.5 Spills of Hazardous Materials and Construction Noise

Other potential short-term construction impacts include accidental spills of hazardous materials (e.g., oil and gasoline) and displacement of spawning or rearing fish by construction noise. Control of hazardous materials is a standard provision in construction contracts and permits. Construction noise should not occur for more than a few days in the vicinity of any given stream crossing. For all in-water work, the timing of the work will be specified in WDFW Hydraulic Project Approval permits to minimize potential impacts. This will normally eliminate the potential impact of noise on listed species. In addition, only limited upland modifications are expected near streams supporting listed species. These species are unlikely to be present during those allowed work windows.

3.2.1.6 Stormwater Facilities

Stormwater Impact Area

The southern portion of the project corridor is in the Issaquah Creek Watershed, the middle portion in the East Lake Sammamish Watershed, and the northern portion in the Bear Creek and Sammamish River Watersheds (see Figure 2). Detailed descriptions of these watersheds are included in the Surface Water and Water Quality Discipline Report for the project (Parametrix 2004a), and summarized below.

Within the project corridor, the Washington State Department of Ecology (Ecology) has identified a number of water bodies in the Category 5 polluted waters/303(d) List of Threatened and Impaired Waterbodies. These include the North Fork of Issaquah Creek, Laughing Jacobs Creek, Pine Lake Creek, Ebright Creek, George Davis Creek, Lake Sammamish, Sammamish River, and Bear Creek.

General Stormwater Design

While stormwater detention and treatment BMPs will apply to the PGIS area constructed as part of the parking and restroom facilities, the runoff from the non-PGIS area of the Trail will not be detained or treated. It is assumed that the Trail runoff will disperse as sheet flow into adjacent vegetated buffer areas for infiltration, or will collect in existing drainage ditches. The Trail will result in an increase of approximately 18.8 acres of new non-PGIS along the project corridor due to the construction of the Trail surface, sidewalks, curbs, and gutters. This increase in impervious surface area is conservative, as it includes the gravel shoulders proposed for either side of the paved trail, and the separate soft-surface trail. Of this total non-PGIS area, approximately 10.8 acres is considered effective impervious area (directly connected to a stream by ditch or pipe) that has a potential to impact streams or ditches. These potential impacts are primarily associated with stream water quantity, as runoff from the majority of the project area (excluding parking lots) is considered non-pollutant generating, because it does not contain the types of pollutants that are typically associated with surfaces used by motorized vehicles (oil, metals, etc.).

Although the additional non-PGIS area has the potential to increase peak flows and reduce base flows in ditches and streams within the project corridor, the overall effects will likely be insignificant or discountable. This is due to the relatively small increase in impervious surface area in any one drainage basin, and also to the location of the Trail near the stream mouths. Runoff management for the 1.2 acres of PGIS from the proposed parking and restroom areas is addressed in Section 3.2.1.3.

No adverse changes in stream sedimentation, bank erosion, or lower stream flows during dry periods are expected due to the following factors:

- The amount of new impervious Trail surface is insignificant enough (particularly compared to the overall size of the drainage basins and the location of the project area near the mouth of these streams) that wetlands and streams will not be measurably affected by any increase in flow rates or flow volumes. Areas draining into wetlands or streams have the potential to increase peak flows or reduce groundwater recharge and summer low flows, although such effects will be minimized because most of the Trail runoff will disperse as sheet flow to adjacent vegetated and gravel buffer areas for infiltration. Stormwater runoff will be discharged within the same subbasin where it originates and will not be conveyed to a different subbasin, thus emulating natural runoff patterns. Much of the Trail runoff drains to adjacent vegetated shoulder buffer areas or to non-fish-bearing ditches or streams running parallel to the Trail, many of which eventually drain to Lake Sammamish via pipes, ditches, or open channels.
- Vegetated clear zones, vegetated buffers, and gravel shoulders are all part of the Trail cross section (see Figure 3). The vegetated clear zones and buffers will be pervious surfaces. These features will be located adjacent to the 12-foot-wide paved trail and are designed to aid in the dispersion and infiltration of surface runoff from the paved portions of the Trail.
- Runoff from the additional impervious surfaces associated with restroom and parking facilities will undergo stormwater management, including detention and/or water quality treatment to meet the applicable standards. Stormwater from all PGIS areas will not be discharged directly into fish-bearing streams without appropriate water quality treatment and detention methods to meet water quality standards.

3.2.1.7 Culvert Replacements and Extensions

Because of the expanded width, the proposed project will require the extension or replacement of 18 culverts (Table 2). While 10 of these occur on fish-bearing streams, none of these streams are known to support ESA-listed fish species. The three project area streams that are known or suspected to supporting ESA-listed species (North Fork Issaquah, Laughing Jacobs, and Bear creeks) are currently spanned by bridges and no substantial modifications of these structures are proposed as part of the Trail project (only potential bridge resurfacing and/or minor repairs). A fourth stream (Pine Lake Creek) could also support Chinook salmon, but the dual culverts under the existing trail are fish passable and will not be modified as part of this project.

Fully fish passable culverts will be installed on all the other designated fish-bearing streams, as well as potential fish-bearing streams (those determined by WDFW to contain suitable fish habitat upstream and/or downstream of the crossing), as needed to provide adequate passage conditions (WDFW 2003). While the designs for individual stream crossings are currently not available, appropriate performance standards will be used for design and construction. Culverts on streams that are not fish-bearing or potentially fish-bearing, will be lengthened but not upgraded to improve fish passage conditions.

Temporary flow diversions will be installed around the in-water construction zone on designated perennial fish-bearing streams, prior to culvert replacement or extension construction activities. These diversions will occur during the driest time of the year and over the shortest time period feasible (typically one to two weeks, depending on the extent of the project work), to minimize potential effects on fish. The in-water construction zone will be screened off prior to and during the stream diversion period, and all fish will be removed prior to dewatering. Netting is the preferred method of fish removal, although electrofishing might be used on streams that do not support ESA-listed fish species. The potential construction impacts from these activities will include increased short-term sedimentation and the disturbance or removal of riparian vegetation adjacent to individual culverts. All in-water work will occur during summer in-water work windows and no ESA-listed species are expected to be present.

Table 2. Proposed Changes to Stream Culvert Crossing Conditions for the East Lake Sammamish Trail Project

Stream Name (Trail Station)	WDFW Stream Type[1]	Fish Use	Existing Stream Crossing	Proposed Project Action
Unnamed Stream (Sta. 145.7)	F	Unknown	24-inch Pipe	Replace with fully fish passable culvert
Unnamed Stream (Sta. 254.2)	Ns	None	18-Inch Pipe	Culvert extension
Unnamed Stream (Sta. 287.9)	Np	None	24-Inch Pipe	Culvert extension
WRIA 08-0155	Np	Unknown	12-inch Pipe	Replace with fully fish passable culvert
Zaccuse Creek	F	Salmon, Trout, Resident	36-inch Pipe	Replace with fully fish passable culvert
Unnamed Stream (Sta. 429.4)	Np	None	36-Inch Pipe	Culvert extension
George Davis Creek	F	Salmon, Trout, Resident	24- and 36-inch Pipes	Replace with fully fish passable culvert
Unnamed Stream (Sta. 446.5)	F	Unknown	24-inch Pipe	Extend existing culvert
Unnamed Stream (Sta. 449.5)	F	Unknown	24-inch Pipe	No culvert changes proposed
Unnamed Stream (Sta. 452.4)	F	Unknown	24-inch Pipe	Replace with fully fish passable culvert
WRIA 08-0143K	Np	None		Culvert extension
WRIA 08-0143J	F	Unknown	12-inch Pipe	Extend existing culvert
Unnamed Stream (Sta. 489.7)	Np	None	12-Inch Pipe	Culvert extension
WRIA 08-0143H (Sta. 496+20)	F	Unknown	8-inch Pipe	Replace with fully fish passable culvert
WRIA 08-0143H (Sta. 500.4)	F	Unknown	Dual 36-inch Pipes	Replace with fully fish passable culvert
WRIA 08-0143M (Sta. 507.6)	F	None	18-inch Pipe	Culvert extension
WRIA 08-0143F (Sta. 525.1)	F	Trout, Resident	12-inch Pipe	Replace with fully fish passable culvert
WRIA 08-0143E (Sta. 530.8)	Unknown	None	24-inch Pipe	Culvert extension
Unknown Drainage	Unknown	None	12-inch Pipe	Culvert extension

[1] Stream Types: S = shorelines of the state, F = high to moderate fish use, Np = perennial non-fish use, Ns = intermittent non-fish use

3.2.2 Operational Activities

Operational activities along the proposed Trail will be similar to existing activities, although Trail use would likely increase due to increased accessibility, and the long-term trail maintenance will likely decrease compared to existing conditions.

Trail Use. In the absence of conservation measures, increased human use of and access to fish-bearing streams will likely cause sloughing or eroding of trail shoulders; disturbance to spawning fish by humans, horses, and pets at stream crossings; fish poaching; trash and debris in the streams. Inappropriate pet waste disposal and horse waste along the Trail alignment could cause an increase in nutrient enrichment and fecal coliform bacteria and thereby degrade water quality.

Trail design elements (soil stabilization, signage, retaining walls, and fencing) and human behavior controls (regulations) will be put in place and enforced to minimize and mitigate these impacts. Trail design elements such as pet waste disposal boxes, clear zones, and planting strip areas adjacent to the Trail will minimize the potential impacts from animal waste. Furthermore, because existing trail uses already allows pets on the Trail, the Trail improvement project is not expected to cause a substantial increase in pet waste compared to existing conditions.

Horse manure is not expected to result in a substantial increase in nutrient enrichment of streams within the East Lake Sammamish/Bear Creek Basins because (1) fences will prevent horses from entering wetlands and streams; (2) vegetation located between the Trail and waterbodies (streams, wetlands, and Lake Sammamish) can filter nutrients and sediment, thereby protecting water quality; and (3) most of the horses using the Trail are expected to come from within the East Lake Sammamish/Bear Creek basins, and thus their potential for contributing nutrients to in-basin streams and Lake Sammamish already exists.

Trail Maintenance. The County currently conducts maintenance activities along the Interim Use Trail, to maintain the integrity of the former railbed, and the aesthetic qualities of the Trail corridor. Since 1999, the County has conducted about 80 projects to repair or restore drainage systems and culverts along the trail corridor, including replacing culverts with bridge structures on some anadromous fish-bearing streams, and removing excessive accumulations of sediment in area drainage ditches. The County also regularly mows, removes litter, replaces deteriorated driveway crossings, installs signage, and removes hazard trees along the corridor. Similar activities will continue to occur for the proposed project.

While culvert and bridge maintenance typically improves stream flows and fish passage, it can potentially disturb sediments and debris and release them downstream, which can impact fish. To a large degree, these impacts are linked to the existing water conveyance facilities of the former railbed, many of which are outdated. These impacts will be reduced because most (but not all) large accumulations of sediment and vegetation develop in the smaller water bodies, as opposed to the fish-bearing streams, where high flows flush these accumulations. In addition, installing fish passage culverts on fish-bearing streams will further reduce the potential maintenance frequency at these locations by allowing less restrictive water flow through the area. Therefore, although the types of maintenance activities will not change as a result of the proposed project, the frequency of such maintenance activities could be somewhat reduced due to the improved water conveyance conditions at some stream crossings. Appropriate BMPs will be implemented for all maintenance activities with the potential to affect water quality or habitat conditions.

4. PROJECT VICINITY ENVIRONMENTAL CONDITIONS

The project site is defined as the area where the majority of the proposed action will occur. Descriptions of the action area, as well as existing conditions for aquatic, terrestrial, and wetland resources are discussed in detail below.

4.1 ACTION AREA

An action area is defined to be "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). Effects from the project are not expected beyond the action area directly affected by the construction. Therefore, based on the analysis detailed in the following paragraphs, the action area for this project includes the immediate work and construction area, all downstream reaches of streams draining the project corridor, and all terrestrial and aquatic habitats potentially affected by the construction or operation of the project.

For the terrestrial portion of the action area, the primary disturbance to wildlife species will be from the visual disturbance and noise generated by construction equipment along the Trail alignment. A noise analysis (Appendix C) calculates that construction activities will elevate the noise level above ambient levels within a maximum distance of 12,800 feet (2.4 miles) from the Trail (Figure 4). This is a conservative estimate because it is based on the loudest activities (pile driving and chain sawing), which will only occur for a portion of the construction period.

The extent of the terrestrial action area is based on the attenuation of the construction noise to a level that is at or below ambient noise levels, which is dominated by the consistent traffic noise along East Lake Sammamish Parkway to the east of the Trail. However, similar traffic noise is expected along the roadway on the western shoreline of the lake, as well as to the northwest and southwest from the State Route (SR) 520 and Interstate 90 (I-90) highways, and to the southeast by the Issaquah-Fall City Road. The noise levels from these other roadways will be greater than the attenuated noise levels of the Trail construction activities, at these locations. Therefore, the terrestrial action area is truncated by these other roadways, such that the action area does not extend past the western shoreline of the lake or past SR 520 or I-90.

For the aquatic portion of the action area, the primary effects will occur through water quality impacts. Turbidity and siltation resulting from construction activities will be minimized through the implementation of BMPs, although some turbidity from construction area runoff might occur. Such turbidity is expected to affect the short stream reaches and other stormwater drainages downstream of the Trail, and possibly result in insignificant and temporary plumes in the lake. Although some pile-driving activities may occur at various locations along the Trail corridor (depending on retaining wall construction process), no in-water pile driving is anticipated. This substantially limits the potential effects of construction noise on the aquatic environment.

Although the aquatic action area will vary substantially, depending on the occurrence of streams or drainage features flowing to the lake, any turbidity entering the lake will be localized to the nearshore areas and temporary in nature. During this phase of the project, BMPs will be implemented and monitored to ensure that sedimentation is avoided or minimized. For the purpose of establishing a conservative aquatic action area component, we assume that the maximum turbidity effects (should the BMPs fail) will not extend more than about 100 feet into the lake (see Figure 4). This 100-foot distance is based on the Ecology and WSDOT (1998) implementing agreement regarding compliance with state water quality standards. This agreement uses the estimated average stream flow at the time of construction to determine the likely mixing zone required to reduce turbidity levels to meet the water quality standards. For estimating the 100-foot mixing zone for this project, we assumed an average stream flow of 10 cubic feet per second or less, during the low-flow construction periods. Although this agreement was developed for flowing stream conditions, we assume that it also provides a reasonable worst-case scenario for the combination of the short stream reaches downstream of the Trail crossings and the slack water lake environment.

Potential water quality impacts will also be mitigated by adherence to the terms of all required permits, as well as complying with the sensitive areas ordinances of King County and the cities of Issaquah, Redmond and Sammamish, the King County Surface Water Design Manual (King County 2005), and the three affected basin plans (King County 1990a, 1994a, 1994b).

4.2 AQUATIC RESOURCES

Most of the project area lies within the 16-square-mile East Lake Sammamish Basin, while the north terminus of the project area is in the Bear Creek Basin, and the southern terminus is in the Issaquah Creek Basin (see Figure 2). The East Lake Sammamish Basin has four main stream systems: George Davis (also known as Inglewood or Eden Creek), Ebright, Pine Lake, and Laughing Jacobs creeks. Numerous small, often seasonally dry streams flow in a predominantly westerly direction from lake and wetland headwaters over the rolling Sammamish Plateau. The streams then flow through ravines down the steep, erosive western slope of the basin before discharging to Lake Sammamish.

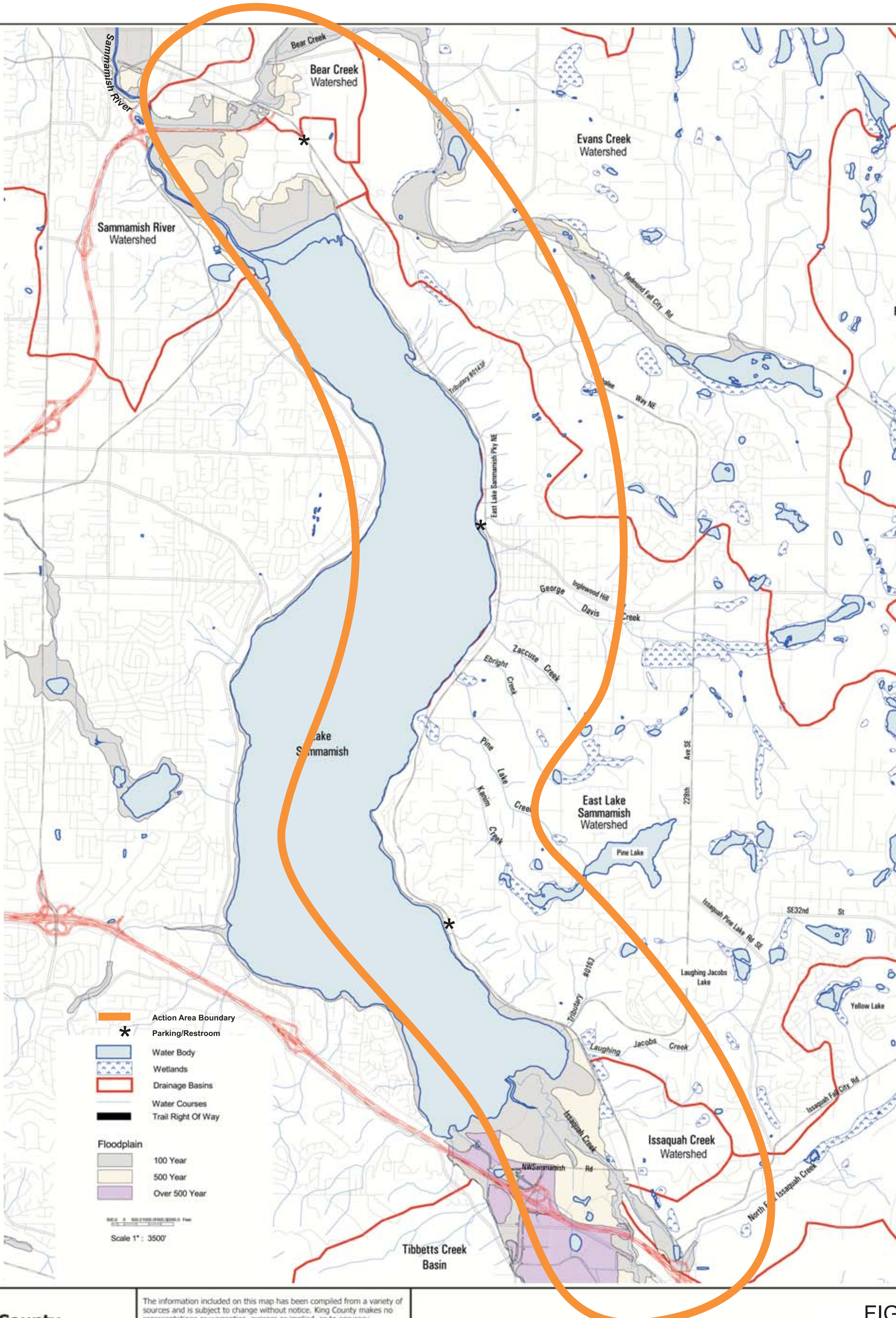
The existing railbed crosses 46 stream channels, most of these having a well-defined bed and bank. Most of these channels carry flowing water at times other than storm events. Approximately seven crossings appear to carry flowing water only during storm events. All crossings consist of streams or storm channels, while no ponds or lakes are crossed by the railbed. Some of the streams are associated with identified wetlands; and their streambeds are vegetated with wetland plants. Other streams do not have streambeds that are vegetated, though their fringes may support wetland plants.

4.3 BEAR CREEK BASIN

Bear Creek Basin, located north of Lake Sammamish, covers approximately 51 square miles and drains into the Sammamish River in Redmond. The upper portions of the watershed are relatively undeveloped. The Trail corridor occurs in the Lower Bear Creek subbasin where land use is predominately urban residential and commercial (King County 1990a).

King County has designated the lower reaches of Bear Creek as a Regionally Significant Resource Area because of its habitat and water quality; it is also one of the most productive salmon spawning streams in WRIA 8 (WSCC 2001). Although it has excellent water quality, within the study area, Ecology lists Bear Creek in its *Category 5 - Polluted Waters/303(d) List of Threatened and Impaired Water Bodies* for temperature and fecal coliform, and in *Category 2 - Waters of Concern* for dissolved oxygen and pH (Ecology 2004).

The 100-year floodplain of Bear Creek is mapped in the vicinity of the project area (FEMA 1998). No local drainage or flooding problems have been reported in this area.



King County
Department of
Natural Resources and Parks
Facilities Management Division

SOURCES:

FIGURE 4
ACTION AREA
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON

4.4 SAMMAMISH RIVER BASIN

The Sammamish River Basin drains a total of 150 square miles. However, all but 26 square miles of this area drain through Lake Sammamish or Bear Creek (King County 1993). The Sammamish River flows north, then west, connecting Lake Sammamish with Lake Washington. The Sammamish River is approximately 13 miles long and relatively linear with a uniform channel configuration along much of its length. Land use adjacent to the river is a combination of urban, residential, and agricultural uses. A portion of the existing Interim Use Trail occurs within an area draining to the Sammamish River. However, this area is located approximately 1 mile from the river, near its source (Lake Sammamish), and no concentrated flow from the railbed reaches the river.

North of the study area, Ecology has listed the Sammamish River in *Category 5 - Polluted Waters/303(d) List of Threatened and Impaired Water Bodies* for temperature and dissolved oxygen; in *Category 4A - Polluted Waters* that have a total maximum daily load (TMDL) for fecal coliform; and in *Category 2 - Waters of Concern* for dissolved oxygen, temperature, and pH (Ecology 2004). FEMA has designated an extensive 100-year floodplain in this area. FEMA has designated an extensive 100-year floodplain for the Sammamish River north of the project area.

4.5 EAST LAKE SAMMAMISH BASIN

The 16-square mile East Lake Sammamish Basin is composed of six major subbasins (from north to south) Panhandle, Inglewood, Monohon, Thompson, Pine Lake, and Laughing Jacobs (Figure 5). These are drained by 14 perennial creeks, 8 intermittent creeks, and 37 additional drainage routes (KCCFM 2000).

The area streams generally originate in wetlands located on the Sammamish Plateau, and drain west through steep ravines to Lake Sammamish. Numerous seeps also emerge along the base of the plateau and supply additional surface water to the area streams and wetlands. Rapid and intense development has degraded the hydrology and water quality in Lake Sammamish and the numerous creeks that drain into the lake (King County 1990b).

The proposed project corridor occurs along the toe slope of the Sammamish Plateau and typically runs perpendicular to natural drainage routes. Local flooding and drainage problems common within the project area have been attributed to: (1) historical alteration of natural drainage patterns by construction and operation of the railroad and East Lake Sammamish Parkway, (2) residential development, (3) natural seeps and springs, and (4) poorly maintained local drainage systems. The main subbasins and surface water features in the East Lake Sammamish Basin are discussed in detail in the following sections.

4.5.1 Panhandle Subbasin

The Panhandle subbasin, located in the northern portion of the East Lake Sammamish Basin, is approximately 3 miles long and relatively narrow (see Figure 5). The subbasin is drained by nine perennial streams, four intermittent streams (Table 3), and numerous seeps, which are characteristically short, high-gradient channels (King County 1994a). Residential development is concentrated along the shores of Lake Sammamish and in portions of the upper watershed (King County 1994a). High-density residential development is predicted to increase in the upper portions of the watershed (KCCFM 2000).

King County field surveys noted no significant water quality problems in any of the Panhandle subbasin drainages. However, all of these drainages have problems with incision in steep stream reaches, and sedimentation in the lower reaches (King County 1994a).

FEMA floodplains are not mapped for any of the streams in this subbasin. However, numerous drainage and local flooding problems within the project area have been reported due to seeps and poor conveyance systems. Generally, development along the Trail in this subbasin is sparse. Nevertheless, local drainage and flooding problems have been reported in this area due to blocked pipes and ditches and altered flow regimes (King County 1994a). Capital improvement projects to replace culverts under the railbed have been identified for several streams (KCCFM 2000).

4.5.2 Inglewood Subbasin

The Inglewood subbasin covers approximately 1,559 acres and drains through George Davis Creek (see Figure 5). George Davis Creek (Inglewood or Eden Creek; Photo 1, Appendix C), originates on the Sammamish Plateau in a network of wetlands and springs. Land use in this subbasin is changing from forested to residential uses (King County 1994a, 1996; KCCFM 2000).

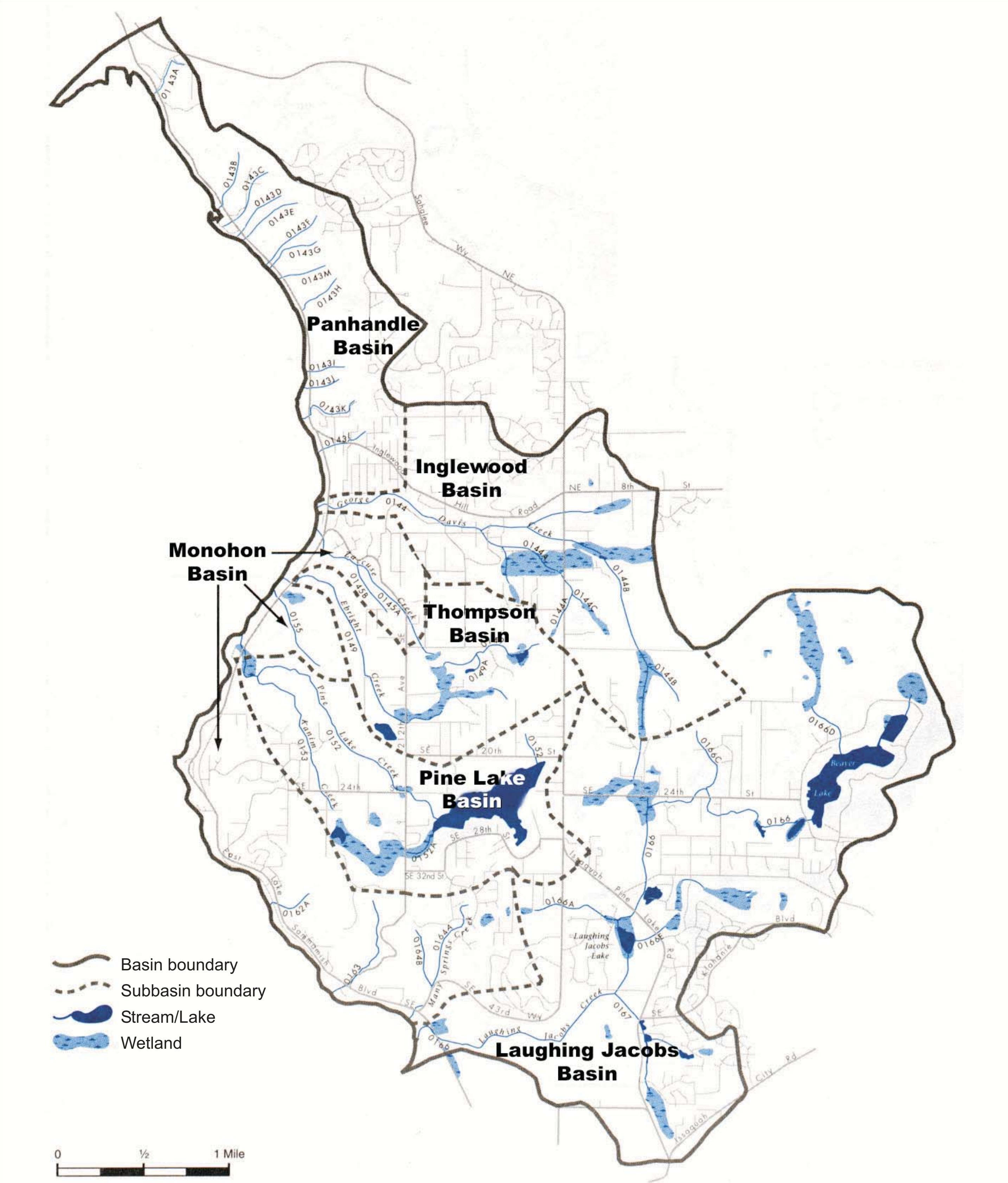
George Davis Creek is a perennial (Type F, Class 2S) stream that supports salmonids. Water quality monitoring in this creek indicates problems with Enterococcus bacteria and nitrogen, possibly due to septic tanks (in a neighborhood serviced by septic systems west of 228th that is frequently flooded) or sewer system leaks. Ecology has listed George Davis Creek in *Category 5 - Polluted Waters/303(d) List of Threatened and Impaired Water Bodies* for temperature and dissolved oxygen; in *Category 4A - Polluted Waters* that have a TMDL for fecal coliform; in *Category 4c - Water Bodies Impaired by a Non-Pollutant* for instream flow and fish habitat; and in *Category 2 - Waters of Concern* for copper and pH (Ecology 2004). Sediment deposition, which is common within the project area, may also degrade water quality and habitat (King County 1994a).

FEMA has not mapped a floodplain associated with this creek, although local flooding along the Interim Use Trail alignment is common and reported to flood adjacent properties during storm events in 1991, 1994, and 1996 (King County 1999a). Two concrete pipes (36-inch and 24-inch diameters) currently convey the creek under the existing railbed. Although these pipes have capacity to convey existing flows, King County has recommended a capital improvement project (CIP) that will replace them with a single 72-inch diameter pipe (King County 1994a). The creek enters another pipe downstream of the railbed and flows under a house before reaching the lake.

4.5.3 Monohon Subbasin

The Monohon subbasin is divided into the north, middle, and south drainages along the eastern edge of Lake Sammamish. The main features of the Monohon subbasin drainage are summarized in Table 4. Much of this basin drains directly to Lake Sammamish without forming distinct channels. Land use within the basin is currently a combination of forest and dense residential. Future development is expected to be predominantly dense residential (King County 1994a).

The northern drainage area in the Monohon subbasin is located between the Inglewood and Thompson subbasins. Zaccuse Creek is the primary drainage feature in this basin, originating in a series of wetlands and flows northwest to Lake Sammamish (Photo 2, Appendix C). It is a Type F, Class 2S stream with salmonids. Channel incision has been reported in the middle reaches of Zaccuse Creek and sedimentation has occurred in the downstream reaches, which degrades water quality. No other water quality problems have been reported in the subbasin (King County 1994a). FEMA has not mapped a floodplain along this creek. Zaccuse Creek is conveyed under the existing railbed in a 36-inch concrete pipe; no flooding problems have been reported although flooding is expected under existing land use conditions assuming a 25-year or greater return frequency storm event discharge rate (King County 1994a).



King County
Department of
Natural Resources and Parks
Facilities Management
Division

SOURCES:

FIGURE 5
EAST LAKE SAMMAMISH WATERSHED
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON

The middle drainage area, located between the Pine Lake and Thompson subbasins, is drained by Stream 0155 (see Figure 5), an intermittent (Type Np, Class 3) stream. Salmonid habitat is limited to the mouth of the stream. The stream is conveyed under the railbed in a 12-inch corrugated metal pipe (CMP). No evidence of flooding problems was observed during a winter 1999 field investigation.

Table 3. Streams in the Panhandle Subbasin, East Lake Sammamish Basin

Stream ID	Trail Station	Classification[1]	Channel Description[2]
0143A	596.2	Perennial Type Np Class 3, Unknown salmonid use	Upstream substrate consists of cobble and riprap. The creek is piped to Lake Sammamish downstream of the railbed.
0143B	550.5	Intermittent Type Ns Class 3	Upstream substrate consists of sand and silt, and the channel lies in a ditch. Downstream the creek is piped to Lake Sammamish.
0143C		Intermittent	Flows into Stream 0143B upstream of the railbed.
0143D	536.1	Intermittent Type F Class 2S	(Not located)
0143E	530.8	Intermittent Class F	Upstream substrate consists of sand and silt, and the channel is straight. Downstream the creek is on private property (not investigated).
0143F	525.1	Perennial Type F Class 2S, No salmonids	Substrate consists of silt and organic debris, and the channel is straight. Downcutting due to erosion at the downstream end of culvert has occurred.
0143G	522.6	Perennial Type F, Class 2S, No salmonids	Substrate consists of a combination of gravel, and sand/silt. Sandbags have been used downstream to dam the creek to divert flow to a fish incubator.
0143M	507.6	Perennial Type F, Class 2, No salmonids	Substrate consists of a combination of gravel, and sand/silt. Upstream slope to East Lake Sammamish Parkway is steep. Approximately 15 feet of downcutting has occurred, and it appears that the bank has poor stability. Less erosion has occurred downstream and channel meanders are present.
0143H	500.4	Perennial Type F, Class 2S, No salmonids	Substrate consists of cobble and gravel. Some downcutting due to erosion has occurred at the downstream end of a culvert.
0143I	486.7	Perennial Type Ns, Class 3	Upstream substrate consists mostly of sand/silt with some gravel. Upstream the slope to East Lake Sammamish Parkway is steep. Downstream the creek is piped to Lake Sammamish.
0143J	484.1	Perennial Type F, Class 2S	Substrate consists mostly of sand/silt with some gravel. The creek is in a ditch upstream of the crossing. Downstream, the creek appears to have poor bank stability.
0143K	470.5	Perennial	Substrate consists of silt/sand. The channel is straight. There was no flow in creek during site visit (despite being classified as perennial).
0143L	456.9	Perennial Type F, Class 2S, No salmonids	Substrate consists of a combination of sand/silt and gravel. Upstream there is a 10-foot drop from East Lake Sammamish Parkway, and siltation problems, and the creek flows through a wetland. Downstream the channel is straight.

1 Based on local jurisdiction class and WDFW stream type classifications, while salmonid use based on King County investigations (1994b).

2 Channel descriptions based on Parametrix, Inc. field investigations conducted in Fall 1999.

Table 4. Streams in the Monohon Subbasin, East Lake Sammamish Basin

Stream ID	Trail Station	Classification[1]	Channel Description[2]
Zaccuse Creek	421.1	Perennial Type F, Class 2S, Salmonids	Substrate consists of cobble and sand/gravel. Upstream the channel is vegetated with blackberry bushes and is part of Wetland 26. Downstream the channel contains riffles and flows into a pipe under a house.
0155	381.2	Intermittent Type Np, Class 3	Could not be located.
0162A	287.9	Intermittent Type Ns, Class 3	Substrate consists of sand/silt. Upstream the channel is in a wet ditch, which is steep and eroded between East Lake Sammamish Parkway and the railbed. Downstream the channel disappears into private lawn.
0163	237.5	Perennial Type F, Class 2S, Salmonids	Substrate upstream consists of silt/sand and it appears to have poor bank stability. Downstream substrate consists of gravel/cobble. Channel discharges to the lake.
Many Springs Creek	211.9	Perennial Type F, Class 2S Salmonids	Substrate consists of silt/sand. Upstream the channel is located in a wet ditch. Downstream the channel flows through Wetland 3.

1 Based on local jurisdiction class and WDFW stream type classifications, while salmonid use based on King County investigations (1994b).

2 Channel descriptions based on Parametrix, Inc. field investigations conducted in Fall 1999.

The southern drainage area contains three notable streams: Many Springs Creek (Photo 3, Appendix C) and Stream 0163 (both perennial streams that support salmonids), and an intermittent stream (Stream 0162A). Many Springs Creek has experienced both channel incision and downstream sedimentation. Although Ecology has not included it on the 303(d) list, water quality has been impaired by fine sediment deposition. Many Springs Creek is conveyed under the existing railbed through a 24-inch CMP. Modeled flow data predict flooding under existing development conditions during a 25-year or greater return frequency storm event (King County 1994a). Streams 0163 and 0162A have no reported water quality problems (King County 1994a). Stream 0163 is conveyed under the existing railbed in a 24-inch clay pipe; no evidence of flooding or capacity problems was observed during a field investigation. Stream 0162A is conveyed in a 24-inch concrete pipe, which has been reported to be undersized (King County 1999a).

4.5.4 Thompson Subbasin

The Thompson subbasin covers approximately 1,176 acres in the middle of the East Lake Sammamish Basin (see Figure 5). Current land use in this subbasin is a combination of rural and urban residential uses and undeveloped land. However, land use is projected to become predominantly urban residential, except for a small area located in the stream ravine that will remain rural (King County 1994a). Ebright Creek, a Type F, Class 2S salmon-bearing creek (Photo 4, Appendix C), is the most notable drainage feature in this subbasin. It is fed by two tributaries that originate in wetlands on the Sammamish Plateau. In the project area, large woody debris and boulders have been placed in the channel to reduce erosion and enhance instream habitat. King County (1994a) documented erosion problems in the upper watershed and sedimentation problems in the lower watershed. Water quality monitoring also indicates that fecal coliform, total phosphorus, and turbidity concentrations have been high during storm events.

FEMA has not mapped a floodplain in the project area. However, hydraulic analyses indicate that the existing railbed lies outside the flood elevation during a 100-year flood event (King County 1999a). A 36-inch concrete pipe and a 36-inch CMP convey Ebright Creek under the existing railbed. Although these culverts have enough capacity to convey the 100-year flood event, a King County CIP has been identified to replace these culverts with a bridge to improve fish passage (King County 1994a).

4.5.5 Pine Lake Subbasin

The Pine Lake subbasin covers approximately 773 acres in the middle of the East Lake Sammamish Basin (see Figure 5). Pine Lake Creek originates on the Sammamish Plateau in Pine Lake and a wetland, and drains west to Lake Sammamish through a steep ravine composed of glacial till soils underlain with highly erodible sandy glacial outwash soils. The main tributary, Kanim Creek, joins Pine Lake Creek upstream of the project area. Downstream of the existing railbed, boulders and large woody debris have been added to the stream to enhance habitat. Current land use in this basin is a combination of forested, rural, and urban residential use; however, future land use will be primarily urban residential (King County 1994a). Pine Lake Creek is a Type F Class 2S perennial salmon-bearing creek, including anecdotal reports of occasionally observing adult Chinook salmon in the lower reaches of the creek (Photo 5, Appendix C).

Ecology has listed Pine Lake Creek in *Category 5 - Polluted Waters/303(d) List of Threatened and Impaired Water Bodies* for dissolved oxygen and fecal coliform (Ecology 2004). Although FEMA has not mapped a 100-year floodplain, hydraulic studies indicate that the existing railbed is outside the local floodplain (King County 1999a). Two 36-inch concrete pipes convey Pine Lake Creek under the existing railbed. Although these pipes can convey the 100-year storm event, a King County CIP recommends that they be replaced with a bridge (King County 1994a).

4.5.6 Laughing Jacobs Subbasin

The Laughing Jacobs subbasin includes approximately 3,600 acres of the southern portion of the East Lake Sammamish Basin (see Figure 5). The basin is drained by Laughing Jacobs Creek (Photo 6, Appendix C), which begins in Laughing Jacobs Lake (wetland), flows through a steep ravine, and discharges to Lake Sammamish near the state park. Although land use in 1989 was approximately 63 percent forested with scattered residential development, the subbasin has been rapidly developed and is expected to reach approximately 89 percent urban development (King County 1994a). The creek is a perennial Type F Class 2 stream that supports salmonid populations, including some reports of Chinook salmon occasionally observed in the lower reaches (King County DNR 2007). Ecology has listed Laughing Jacobs Creek in *Category 5 - Polluted Waters/303(d) List of Threatened and Impaired Water Bodies* for fecal coliform and in *Category 4c – Water Bodies Impaired by a Non-Pollutant* for instream flow and fish habitat (Ecology 2004). This stream also has a high phosphorus content and sediment loads, which originate from active landslides in the lower reaches of the creek (the upper portions are underlain by bedrock) (King County 1990b). The creek crosses under the Interim Use Trail, supported by a bridge.

FEMA has not designated a 100-year floodplain associated with Laughing Jacobs Creek. However, hydraulic modeling of the creek has been used to map a local floodplain within the project area (King County 1999a). Results from this study indicate that the existing railbed is located above the flood stages predicted for a 100-year storm event. The existing railbed crosses the creek on a bridge, which has enough capacity to convey the 100-year flood event.

4.6 LAKE SAMMAMISH

Lake Sammamish, with a surface area of approximately 4,900 acres, is one of the largest lakes in the Puget Sound Basin (King County 1999b). The lake receives flow primarily from Issaquah Creek and discharges north through the Sammamish River to Lake Washington, Lake Union, and Puget Sound. Most of the watershed is located within the King County urban growth area (UGA) boundary and is (or is proposed to be) developed with high-density residential and commercial land uses (King County 1994a; KCCFM 2000). Within the project area residential development has been concentrated between the East Lake Sammamish Parkway and the lakeshore.

Lake Sammamish is listed as a King County Sensitive Lake because water quality studies conducted over the last 30 years have shown that the lake is sensitive to phosphorus loading (King County 1990b). In 1968, Metro completed a water quality improvement project that ended direct discharges of sewer effluent to Lake Sammamish (King County 1999b). To further protect the lake, King County has adopted strict water quality and stormwater standards that regulate basin development to protect the lake from excessive phosphorus loads and to reduce problems with low dissolved oxygen (King County 1998). Lake Sammamish receives flow primarily from Issaquah Creek. The lake discharges north through the Sammamish River to Lake Washington. It is listed by King County as a sensitive lake due to phosphorus loading. Along the eastern portion of Lake Sammamish, adjacent to the project corridor, Ecology has listed Lake Sammamish in *Category 5 - Polluted Waters/303(d) List of Threatened and Impaired Water Bodies* for total phosphorus, sediment bioassay, ammonia-N, fecal coliform, and dissolved oxygen (Ecology 2004). In addition, elevated metal levels were found throughout the sediments of Lake Sammamish, and elevated organic levels were found near storm drains (King County 2003a).

FEMA has mapped a 100-year floodplain, along the eastern edge of the lake, and all of the existing railbed is located outside the floodplain. However, portions of the project area are located within the floodplain (FEMA 1995).

4.6.1 Issaquah Creek subbasin

The Issaquah Creek Basin covers approximately 61 square miles in the southern portion of the Lake Sammamish Basin (see Figure 2). The North Fork subbasin, containing the proposed Trail, covers approximately 2,855 acres. Flow in this subbasin originates on the Sammamish Plateau at Yellow Lake, and enters the main fork of Issaquah Creek just upstream of Lake Sammamish. The North Fork of Issaquah Creek (Photo 7, Appendix C) is low gradient in the upper and lower reaches but flows through a steep ravine near the middle of its watershed. The subbasin is nearly 75 percent forested (King County 1994b) with portions of the basin developed with high-density residential uses. Development within the basin is projected to increase. Water quality problems in the North Fork are due to runoff from impervious surfaces in Issaquah, and discharges from a storm sewer outfall at River Mile 0.2, which is downstream of the Interim Use Trail (King County 1994b).

Ecology has listed the North Fork of Issaquah Creek in *Category 4c – Water Bodies Impaired by a Non-Pollutant* for fish habitat (Ecology 2004).

Flooding is concentrated in the lower reaches of the subbasin where FEMA has mapped a 100-year floodplain (FEMA 1995). The existing railbed is elevated above the 100-year flood elevation on fill.

4.7 BASELINE STREAM WATER QUALITY

Within the project corridor, Ecology has identified the following water bodies: the North Fork of Issaquah Creek, Laughing Jacobs Creek, Pine Lake Creek, Ebright Creek, George Davis Creek, Lake Sammamish, Sammamish River, and Bear Creek, in the Category 5 polluted waters/303(d) List of Threatened and Impaired Waterbodies (Table 5).

Table 5. Summary of Category 5 Polluted Waters in the Project Area

	Category 5: Polluted Waters/303(d) Parameters					
Water Body	**Temperature**	**Fecal Coliform**	**Dissolved Oxygen**	**Total Phosphorous**	**Sediment Bioassay**	**Ammonia-N**
N. F. Issaquah Creek		X				
Laughing Jacobs Creek		X				
Pine Lake Creek		X	X			
Ebright Creek		X				
George Davis Creek	X		X			
Lake Sammamish		X	X	X	X	X
Sammamish River	X		X			
Bear Creek	X	X				

In addition, King County identified Lake Sammamish as particularly sensitive to phosphorus, with documented water quality problems related to phosphorus loading. Bear Creek has been designated a “regionally significant resource area” that requires special BMPs for water-quality treatment and higher standards for stormwater runoff detention (King County 1990a. Ecology has established a total maximum daily load (TMDL) for fecal coliform in the Sammamish River. Development of a TMDL is one method Ecology uses to help clean up polluted waters. A TMDL is used to identify the maximum amount of a pollutant that can be released into a waterbody without impairing the designated uses of the water, and allocate that amount among various sources.

4.8 WETLANDS

The cities of Issaquah, Sammamish, and Redmond each regulate development and land use activities in wetlands and wetland buffers through their respective sensitive areas (or critical areas) regulations. These local regulations, including wetland buffer widths required by each jurisdiction, are summarized in Appendix J of the *East Lake Sammamish Master Plan Wetland Biology Discipline Report* (Parametrix 2004b).

Approximately 78 wetland areas were identified in, or directly adjacent to, the Trail corridor (Parametrix 2004b) (Table 6). These wetlands are grouped into five categories based on their topographic conditions and patterns of water sources. These groups were established based on the hydrogeomorphic classification approach (Brinson 1993), an accepted method for evaluating wetlands and their ecological functions.

Table 6. Summary of Wetlands within the East Lake Sammamish Master Plan Trail Wetlands Study Area

Hydrogeomorphic Classification (number of wetlands)	Stream Association	Local Jurisdiction	USFWS Classification[1]	Ecology Wetland Rating	Local Rating	Total Acres
Closed Depression (2)	n/a (2)	Issaquah (1) Sammamish (1)	PEM (1) PSS (1)	III (2)	3 (1) NR (1)	0.08
Slope (16)	n/a (13) Pine Lake & #0155 (1) Unnamed (1) #0143L (1)	Issaquah (1) Sammamish (14) Redmond (1)	PEM (11) PFO (5)	I (2) II (1) III (13)	1 (2) 2 (4) 3 (9) NR (1)	3.55
Modified Slope (32)	n/a (32)	Issaquah (12) Sammamish (18) Redmond (2)	PEM (24) PSS (3) PFO (5)	III (32)	2 (5) 3 (22) NR (5)	3.81
Modified Riverine Associated with Fish-Bearing Stream (20)	N. F. Issaquah Ck. (3) Trib #1 to Lk. Sam (3) Many Springs Ck.(2) Pine Lake & #0155 (3) Ebright Ck. (3) Zaccuse Ck.(2) 0143L (1) 0143D (2) Bear Ck. (1)	Issaquah (8) Sammamish (11) Redmond (1)	PEM (6) PSS (7) PFO (7)	III (19) NR (1)	2 (16) 3 (3) NR (1)	6.15
Modified Riverine Associated with Non-fish Bearing Stream (8)	Trib #1 to N. F. Issaquah Ck. (2) Trib #2 to Lk. Sam (1) Unnamed (2) #0150 (2) #0143I (1)	Issaquah (3) Sammamish (5)	PEM (4) PSS (3) PFO (1)	III (8)	2 (2) 3 (5) NR (1)	1.55
					Total	**15.14**

[1] Key to the USFWS classifications:
PEM Palustrine Emergent
PSS Palustrine Scrub-shrub
PFO Palustrine Forested

Two closed depression wetlands occur in the project area. These wetlands are relatively small, hydrologically isolated areas with no surface drainage channels present. Groundwater discharge and precipitation are the major sources of water for both wetlands.

Sixteen slope wetlands occur between Lake Sammamish and the Trail corridor (i.e., the former railbed), and generally drain surface water directly to the lake. Groundwater is the major source of water for these wetlands. Although most of these wetlands are emergent wetlands, five have a forest cover consisting of red alder, black cottonwood, and Oregon ash overstory and the common understory shrubs salmonberry, Pacific ninebark, and red osier dogwood.

Thirty-two modified slope wetlands occur in the project area, where topography and water flow were modified by road or railroad construction such that they now include some natural slope wetland, but also constructed depressions and/or ditches. In addition, clearing, mowing, grading, or other human activities have modified vegetation and habitat conditions in nearly all of these wetlands, reducing the cover of native vegetation. Yard waste, construction debris, and other trash have also degraded several of these wetlands; however, the existing

Interim Use Trail maintenance program removes these items as needed. These wetlands typically support emergent vegetation dominated by reed canarygrass, although five are forested (primarily young red alder, black cottonwood, and Pacific willow trees) and three support shrub vegetation (i.e., willow, red alder saplings, red osier dogwood, and twinberry).

Twenty of the wetlands in the study area are associated with fish-bearing streams, and eight are associated with non fish-bearing streams. These wetlands range in size from less than 0.03 to 1.0 acre within the study area, and most are linear or trough-shaped. A seasonally high groundwater table, overbank flows from the streams, and surface runoff support the hydrology of these forested, emergent, and scrub-shrub wetlands. The forested vegetation includes Oregon ash, black cottonwood, Pacific willow, and red alder. The shrub vegetation is generally composed of young Pacific willow and red osier dogwood, peafruit rose, Douglas spirea, and Himalayan blackberry. Also present in fewer numbers are other willow shrubs and Oregon ash saplings. Emergent vegetation is most commonly reed canarygrass and ladyfern, soft rush, giant horsetail, scouring rush, and small-fruited bulrush. Common cattail occurs in the center of some of the troughs within these wetlands.

4.9 GEOGRAPHY AND SOILS

Existing topography in the study area and vicinity was heavily influenced by the Vashon Ice Sheet, which occupied the area and retreated to the north approximately 13,000 years ago. Lake Sammamish occupies a glacially excavated, elongate trough bounded by north-south trending elongate ridges and drift uplands.

The central 7 miles of the project area is located on the eastern slope of this trough, near the toe of slope and near the lakeshore. The crest of the slope lies to the east (Sammamish Plateau), ranges generally from 150 to 165 feet in elevation, and is within 0.5 mile of the Trail corridor. The corridor passes perpendicular to steep erosion- or landslide-prone slope faces including the slopes lying between the railbed and the parkway, and perpendicular to the regional drainage pattern.

The northern and southern portions of the project area occur on relatively flat alluvial plains bounded by ridges and drift plains (north) or generally east-west trending foothills (south). In the Redmond area, the study area departs from the Lake Sammamish trough and crosses the alluvial valley formed by Bear and Evans creeks. In the south, the project area crosses the alluvial plain formed by Issaquah Creek and its tributaries.

The surficial geology crossed by the study area includes alluvium deposited by streams and landslides, and lacustrine and glacially deposited silts. Dense to very dense Vashon-age, glacially consolidated deposits form the slopes, with loose to medium-dense deposits derived from post-glacial erosion and land slides forming the lower areas. Both the railbed and the adjacent roads are engineered on cuts in the dense materials. In a few locations, the railbed and roads are built on fills in former wetland and other loose alluvium.

Elevations along the Trail corridor range from 42 feet in the north to 70 feet in the south, which are nearly the same elevation as East Lake Sammamish Parkway. In the central 7–mile portion of the Trail corridor however, the parkway is typically 20 to 80 feet upslope of the railbed. Soils in the Trail corridor are mapped into 15 soil mapping units composed of 13 individual soil series (Snyder et al. 1973). The railbed and much of the parkway comprises fill. The mapped soils have been categorized as either non-hydric (upland) (Table 7) or hydric (wetland) (Table 8). Generally, soils in the study area are mapped as non-hydric. Hydric soil inclusions[1] are reported to occur within these non-hydric units (Snyder et al. 1973).

[1] Inclusions are areas of distinct soil types too small to be mapped separately.

Table 7. Non-hydric Soils Mapped in the Vicinity of the Study Area

Non-hydric Soils	Phase	Slope (percent)	Drainage Class	Parent Material	Landscape position	Erosion hazard	Taxonomic Subgroup	Soil Order
Alderwood	Gravelly sandy loam	6 to 15 and 15 to 30	Moderately well drained	Glacial till	Terraces	15 to 30: severe	Entic Durochrepts	Inceptisol
Everett	Gravelly sandy loam	5 to 15 and 15 to 30	Somewhat excessively well drained	Glacial outwash	Terraces and terrace fronts	15 to 30: moderate to severe	Dystric Xerochrepts	Inceptisol
Indianola	Loamy fine sand	0 to 4	Somewhat excessively drained	Sandy recessional glacial drift	Smooth terraces	Insignificant	Dystric Xeropsamments	Entisol
Kitsap	Silt loam	2 to 8 and 15 to 30	Moderately well drained	Glacial lake deposits	Terraces and strongly dissected terrace fronts	15 to 30: severe	Dystric Xerochrepts	Inceptisol
Alderwood/ Kitsap complex	50 percent Alderwood, 25 percent: Kitsap, 10 percent: Indianola 15 percent: unnamed	25 to 70	Varied	Glacial till, outwash, and lake deposits	Terrace fronts	Severe to very severe	N/A	N/A
Ragnar/Indianola complex	50 percent: Ragnar fine sandy loam 50 percent: Indianola loamy fine sand	2 to 15 (convex) and 15 to 25 (convex to concave)	Well drained	Glacial outwash	Glacial outwash terrace fronts	Severe for steep slopes	N/A	N/A
Mixed Alluvial land: areas too small and too closely associated to map separately at the scale used.	Ranges from sand and gravelly sand to silty clay loam	Less than 2	From well drained to very poorly drained	Alluvium	Stream and river valleys	Insignificant	N/A	N/A

Table 8. Hydric Soils Mapped in the Vicinity of Study Area.

Hydric Soils	Phase	Slope (percent)	Drainage Class	Parent Material	Landscape Position	Taxonomic Subgroup	Soil Order
Bellingham	Silt loam	Less than 2	Poorly drained	Alluvium	Depressions on till plains	Typic Humaquepts	Entisol
Earlmont	Silt loam	Less than 2	Somewhat poorly drained	Diatomaceous lake deposits	Lake beds	Typic Fluvaquents	Entisol
Norma	Sandy loam	Less than 2	Poorly drained	Till and alluvium	Stream bottoms and depressions on till plains	Fluventic Humaquepts	Inceptisol
Oridia	Silt loam	Less than 2	Somewhat poorly drained	Alluvium	River valleys	Typic Fluvaquents	Entisol
Sammamish	Silt loam	Less than 2	Somewhat poorly drained	Alluvium	Stream valleys	Fluvaquentic Humaquepts	Inceptisol
Seattle	Muck	Less than 1	Very poorly drained	Sedges	Depressions and stream valleys on till plains	Typic Medihemist	Histosol
Shalcar	Muck	Less than 1	Very poorly drained	Stratified organic material and alluvium	Depressions and stream valleys on till plains	Terric Medisaprists	Histosol
Woodinville	Silt loam	Less than 2	Poorly drained	Alluvium	Stream bottoms	Typic Fluvaquents	Entisol

In the northern and southern portions of study area, soils that have formed in alluvium and the former lake basin may have perennially or seasonally high ground water and are classified as hydric. These areas generally were also mapped as wetlands by the soil survey and the National Wetlands Inventory (NWI).

4.10 VEGETATION

Vegetation in the study area was categorized into four major types: urban matrix, deciduous tree cover (both upland and riparian), coniferous tree cover (upland only), wetland including forested, shrub, and emergent wetland types (Table 9).

The urban matrix is the most predominant vegetative class in the project area, consisting of a mix of buildings, asphalt, ornamental gardens, lawns, and shrubby/grassy areas with scattered trees. Naturally occurring deciduous trees, such as big leaf maple, are generally 20 to 40 feet tall. Dominant shrub species are Himalayan blackberry, Scot's broom, and a variety of ornamental species. Non-native pasture species dominate the unmanaged grassy areas. Reed canarygrass and/or Himalayan blackberry dominate many wetland and upland areas.

Deciduous forest cover type consists of mostly deciduous trees such as Oregon ash, black cottonwood, and bigleaf maple with an understory of swordfern, salal, Himalayan blackberry, and salmonberry. Trees are generally more than 40 feet tall, and some cottonwoods reach more than 150 feet in height.

Coniferous forest cover type consists of mostly coniferous trees (Douglas fir, western red cedar, and western hemlock, with an understory of swordfern, low Oregon grape, Himalayan blackberry, and English ivy. Trees in this cover type are generally 40 to 80 feet tall. Coniferous tree cover occurs as small patches (up to approximately 2 acres) in upland areas.

Table 9. Typical Plant and Wildlife Species Present in the Project Area

Vegetation Community	% of Project Area	Typical Vegetation	Typical Wildlife Species	
Urban Matrix	70%	Ornamental and native trees Mixed turf grasses Ornamental shrubs Scot's broom Himalayan blackberry	European starling American robin American crow Dark-eyed junco Spotted towhee House finch	House sparrow Black-capped chickadee Opossum Raccoon Deer mice Norway rat
Coniferous Forest	5%	Douglas-fir Western red cedar Red alder Salal Swordfern Evergreen huckleberry Indian plum Vine maple	Ruby-crowned kinglet Steller's jay Red-breasted nuthatch Pileated woodpecker	Vagrant shrew Shrew-mole Black-capped chickadee American robin Song sparrow

Table 9. Typical Plant and Wildlife Species Present in the Project Area (continued)

Vegetation Community	% of Project Area	Typical Vegetation	Typical Wildlife Species	
Deciduous Forest	5%	Big leaf maple Red alder Beaked hazelnut Swordfern Salal Common snowberry Himalayan blackberry Oregon grape	Warbling vireos, Orange-crowned warbler Song sparrow Spotted towhee Black-throated gray warbler	Black-headed grosbeak Western tanagers Beaver Red-tailed hawk Bald eagles Garter snake
Wetland	10%	Black cottonwood Oregon ash Pacific ninebark Pacific willow Sitka willow Himalayan blackberry Reed canarygrass Soft rush Cattail	Great blue heron Mallard Canada geese Belted kingfisher Red-winged blackbird Willow flycatcher Red-tailed hawk Northern harrier Various waterfowl	Bewick's wren Pacific treefrog Garter snake Beaver Muskrat Salamander Skunk Weasel Vole, mole and shrew

[a] Approximate percent of the study area dominated by each community type.

4.11 WILDLIFE HABITAT

Wildlife species occurring in the project area tend to differ according to vegetation types, with the urban matrix type being the most dominant vegetation in the project area (see Table 9). Wildlife species present in the urban matrix cover type are habitat generalists that are adapted to a wide variety of conditions. Characteristic species include European starling, American robin, American crow, dark-eyed junco, spotted towhee, house finch, house sparrow, black-capped chickadee, opossum, raccoon, deer mice, and Norway rat.

Wildlife species associated with the deciduous tree cover type include a variety of songbirds and raptors, small mammals, and a few species of amphibians and reptiles. Deciduous trees and shrubs provide nesting habitat, cover, and forage for songbirds such as warbling vireo, orange-crowned warbler, song sparrow, spotted towhee, black-throated gray warbler, black-headed grosbeak, and western tanager (a species observed in the area by residents – Eychaner 1999). Deciduous areas along streams also provide habitat for beaver. Large cottonwoods present in this cover type are particularly important as potential perch and nest sites for raptors, such as red-tailed hawk, osprey, and bald eagle. Amphibians and reptiles expected to occur in the deciduous tree cover type include common garter snakes and possibly ensatinas (a type of salamander).

Wildlife species characteristic of the coniferous tree cover type include ruby-crowned kinglet, Steller's jay, red-breasted nuthatch, pileated woodpecker, vagrant shrew, and shrew-mole. Pileated woodpecker is a state candidate species for listing, and their occurrence in the project area is described in greater detail later in this section. During winter, coniferous trees provide important cover for a variety of birds, such as black-capped chickadee, Steller's jay, American robin, and song sparrow.

4.12 ENVIRONMENTAL BASELINE CONDITIONS

4.12.1 Terrestrial Species

The project area occurs within a narrow corridor confined by East Lake Sammamish Parkway and Lake Sammamish. This area consists of variable density residential development along much of the corridor, particularly between the Trail and the lake. The Trail has a relatively continuous vegetated buffer on both sides, through much of the corridor. This buffer vegetation includes numerous trees (typically 40-plus feet tall), which provide perches near the lake for eagles and other raptors. The lake provides abundant forage opportunities on fish (residential and seasonal anadromous adult concentrations) and waterfowl.

In addition to the immediate Trail corridor, the relatively steep gradient between the lake and the Sammamish Plateau of up to about a 400-foot elevation change, provides relatively abundant territorial perch trees. Patches of relatively undisturbed coniferous forested areas on these slopes also provide relatively good quality nesting habitat, despite the residential housing development pressures in the area. The adequacy of the habitat to support these raptor species is reflected in the relatively dense eagle nesting distribution (three nests within about 10 miles), despite the substantial level of human activity in the area.

4.12.2 Aquatic Species

The Checklist for Documenting Environmental Baseline and Effects of Proposed Actions(s) on Relevant Indicators (NMFS 1996a) is included as Table 10 and used to assess current baseline parameters as well as to guide the determination of effect for the proposed action on Chinook salmon and bull trout. A description and discussion of the environmental baseline and effects of the action on the individual indicators is presented in Appendix E.

Due to the overall length of the project corridor and the substantial differences between the various streams intersected by the project, the environmental baseline and effects assessment is based on the typical conditions in the project area. In addition, the assessment primarily addresses fish-bearing or potentially fish-bearing streams. The majority of the indicators are at risk, and the limited extent of the project effects will result in maintaining these existing conditions. Although the watershed condition indicators are currently not properly functioning, due to extensive urban development throughout the area, the limited extent of project impacts will also result in maintaining these conditions. However, the project will restore fish passage conditions on a number of tributaries intersected by the Trail corridor, which are currently not properly functioning. Fish passage conditions will occur not only on current fish-bearing streams, but on other streams with potential fish-bearing characteristics.

Table 10. Checklist for Documenting Environmental Baseline and Effects of Proposed Action(s) on Relevant Indicators

PATHWAYS Indicators	ENVIRONMENTAL BASELINE			EFFECTS OF THE ACTION(S)		
	Properly Functioning[1]	At Risk[1]	Not Properly[1] Functioning	Restore[2]	Maintain[3]	Degrade[4]
Water Quality						
Temperature		X			X	
Sediment		X			X	
Chemical Contamination/Nutrients			X		X	
Habitat Access						
Physical Barriers			X	X		
Habitat Elements						
Substrate		X			X	
Large Woody Debris			X		X	
Pool Frequency		X			X	
Pool Quality		X			X	
Off-Channel Habitat		X			X	
Refugia		X			X	
Channel Condition and Dynamics						
Width/Depth Ratio		X			X	
Streambank Condition		X			X	
Floodplain Connectivity		X			X	
Flow/Hydrology						
Peak/Baseflows			X		X	
Drainage Network Increase		X			X	
Watershed Conditions						
Road Density/Location			X		X	
Disturbance History			X		X	
Riparian Reserves			X		X	

Watershed Name: Bear Creek/East Lake Sammamish/N. Fork Issaquah Creek basins

1 These three categories of function (*properly functioning*, at risk, and *not properly functioning*) are defined for each indicator in the "Matrix of Pathways and Indicators."

2 For the purposes of this checklist, *restore* means to change the function of an *at risk* indicator to *properly functioning* (it does not apply to "*properly functionin*g" indicators).

3 For the purposes of this checklist, *maintain* means that the function of an indicator does not change (i.e., it applies to all indicators regardless of functional level).

4 For the purposes of this checklist, *degrade* means to change the function of an indicator for the worse (i.e., it applies to all indicators regardless of functional level). In some cases, a "not properly functioning" indicator may be further worsened, and this should be noted.

5. EFFECTS OF PROJECT ON ENVIRONMENT

5.1 DIRECT EFFECTS

The proposed project has several potential effects on the surrounding environment. These effects are listed in Table 11 and discussed in further detail below.

Table 11. Unavoidable Impacts to the Environmental Baseline and Offsetting Conservation Measures for the East Lake Sammamish Master Plan Trail Project

Impact/Habitat Degradation	Conservation Measure/Mitigation
About 1.04 acres of wetlands, 3.9 acres of wetland buffer, and 2.3 acres of stream buffers will be impacted by the project. These wetlands are located on or adjacent to numerous tributaries to Lake Sammamish, potentially altering water quality and quantity within the action area	Wetland and buffer mitigation will be conducted onsite and/or offsite. The mitigation plan will satisfy the most stringent level of regulatory requirements and replace affected functions and values within the project area at an equal or greater rate than provided for by existing conditions.
Increase of about 20 acres of impervious surface	Most of the increase (18.8 acres) is non-pollutant generating impervious surface area, and primarily includes areas currently occupied by the Interim Use Trail, with existing compacted fill material with limited infiltration capacity. Trail runoff will consist primarily of sheet flow to unpaved gravel shoulders and vegetated buffers for dispersion.
Modification of 18 culverts (lengthened or replaced) to accommodate the proposed Trail.	Net improvement to fish passage conditions in the Trail corridor by replacing barrier culverts on fish-bearing or potential fish-bearing streams. ESA-listed fish species are not known to occur in these streams. Impacts to ESA-listed fish species will be further minimized by: • Timing the in-water work to the portion of the year when protected species are least likely to be present and limiting the duration of in-water work to the HPA work window. • Diverting stream flows around the culvert replacement site to minimize potential effects on temporary water quality conditions. • Using retaining walls to minimize fill to sensitive areas • Re-vegetating disturbed areas as quickly as possible • Implementing BMPs to reduce erosion and sedimentation, and debris entering project waters (silt fencing, containment tarps, etc.).
Installation of about 26,000 linear feet of retaining wall adjacent to the Trail corridor.	Retaining walls minimize the amount of fill required in the project area, particularly in sensitive areas such as wetlands, streams, and riparian areas. Any in-water work associated with retaining wall construction will have similar conservation measures as those provided above for the culvert work.
Potential acoustic effects on bald eagles associated with trail construction activities within bald eagle habitat.	Minimize effects by restricting disturbing construction activities (i.e., pile driving and tree falling) within 0.5 mile of active nest sites during the nesting period, and documented roost sites during the wintering period,.

5.2 TERRESTRIAL NOISE

Construction noise can affect terrestrial species and temporarily alter habitat use. Construction activities associated with the East Lake Sammamish Trail Project that are likely to generate the most noise disturbance to terrestrial species, including bald eagle, include the use of standard construction equipment such as chain saws, dump trucks, backhoes, graders, and pavers.

Based on the terrestrial noise analysis (Appendix C), project-related construction noise will equilibrate to ambient noise levels at a point 2.4 miles away from the construction location (assuming still air and ideal conditions). This area includes all of Lake Sammamish and also includes known bald eagle nest locations. Bald eagles are also known to forage along Lake Sammamish, including the action area, and therefore may also be exposed to noise levels that could cause disturbance to foraging activity. However, the noise levels from Trail construction activities are expected to be similar to regularly occurring noises in the area, such as boats and jet-skis on the lake, lawn mowers, chainsaw use when clearing land for residential housing, and other residential construction activities. As a result, the eagles that regularly nest along the eastern shoreline of Lake Sammamish are expected to be habituated to such noises. Therefore, restricting the use of loud construction equipment (i.e., pile driver, jackhammer or chainsaw) within 0.5 mile of an active nest site during the nesting period (January 1 to August 15) or a documented roost site during the wintering season (October 31 to March 31), will result in no measurable effects to eagles (see Appendix C). This threshold distance corresponds to a noise level of about 70 dBA at the nest or roost site. Therefore, the location of other construction activities will also be restricted if they are likely to produce noise levels greater than about 70 dBA at active nest or documented roost sites during the nesting or wintering periods, respectively.

5.2.1.1 In-water Noise

Construction activities associated with the Trail project are unlikely to generate substantial sound in the aquatic environment because these activities will occur in the dry (after diverting water around in-water construction sites). Because ESA-listed fish species (Chinook salmon, bull trout, and steelhead) are not known to occur in project area streams identified for culvert extension or replacement activities, no direct effects are expected.

5.2.2 Effects on Water Quality

Potential impacts to water quality in the project area could result from both the construction phase, and the long-term operational phase of the Trail.

5.2.2.1 Construction Phase

Construction impacts could result from (1) temporary increases in erosion and sedimentation from disturbed soil areas and potential spills of fuel or oil at staging areas, (2) in-water work associated with culvert extensions or replacement on perennial streams, (3) dewatering and cast-in-place concrete work for retaining wall construction, and (4) work in or adjacent to wetlands. Any construction impacts will be temporary and will be minimized or prevented through proper implementation of appropriate BMPs.

Excavation activities at or near stream crossings and wetlands have the potential to cause temporary impacts to water quality. However, ESA-listed fish species (Chinook salmon, bull trout, and steelhead) are not known to occur in streams directly affected by these construction activities. Although these species are expected to occasionally occur in Lake Sammamish, downstream of the Trail construction activities, implementation of construction BMPs, diverting flows around the construction sites, and limiting in-water construction activities to the approved in-water construction period are expected to eliminate the potential to affect these species while in the lake.

Heavy equipment required for construction activities could potentially result in an increase in fine sediment, which could temporarily impact water quality. Vegetation removal, grading, and fill activities could also increase erosion along ditches, wetlands, or streams adjacent to the existing railbed and Interim Use Trail, although implementation of construction BMPs is expected to minimize or eliminate such effects. Heavy machinery could also impact water quality by increasing the potential for spills (such as oil or gasoline). However, given the relatively short duration of construction in any one location, and the use of appropriate BMPs, these effects are not expected to be significant.

The construction of retaining walls to minimize the amount of fill or excavation in sensitive areas (wetlands, riparian buffers and stream channels) could result in increased pH levels, from leaching of fresh concrete. Such effects will be minimized by implementing appropriate BMPs, including isolating all sensitive areas prior to pouring concrete, and preventing any fresh or curing concrete from coming in contact with surface water that is not detained or treated.

5.2.2.2 Operational Phase

The causes of operational impacts for this proposed project could be divided into four general categories: (1) new impervious surface area, (2) culvert extensions, (3) animal waste, and (4) operational maintenance activities. The potential impacts associated with each category are described below. In general, none of these activities is expected to have measurable adverse impacts to water resources in the project area because they will not result in substantial differences from existing conditions and activities on the Interim Use Trail.

New impervious surface has been linked to increases in the frequency of peak flow rates and the volume of stormwater runoff, potentially resulting in increases in bed incision and bank erosion and altered hydroperiod in wetlands. Eroded sediment, deposited in downstream stream reaches, could lead to drainage problems and local flooding. In addition, large areas of new impervious surface could reduce groundwater recharge and summer low flow, and increase summer temperatures. However, the project corridor makes up a very small part of the overall watershed, rendering the potential impacts of increased erosion and reduced groundwater recharge and temperature increases immeasurable.

Because the majority (94 percent) of the new impervious surface area is also non-pollution generating, Trail operations will have minimal effects on water quality. The three parking areas (totaling about 1.2 acres) are the only PGIS areas constructed for the Trail project that could have the potential for impacting area water quality. Such impacts will vary depending on the amount of PGIS, intensity of use, duration and intensity of storm events, time of year, and proximity to sensitive areas. Contaminants related to parking areas are similar to those for roads and highways, principally total suspended solids (TSS), dissolved and total zinc, and dissolved and total copper.

Parking lot runoff may also contain low levels of cadmium, lead, chromium, and polycyclic aromatic hydrocarbon (PAH) compounds (Appendix F). Often, these compounds are at or below levels that can be detected with current analytical methods and may be effectively filtered or settled out in stormwater BMPs prior to discharges to nearby waterbodies. Based on the environmental chemistry and biological fate of these compounds in an aquatic system, exposure to ESA-listed species is likely discountable, given the relatively small size (1.2 acres) of the proposed parking areas, the expected frequency of use, and stormwater BMP implementation. In addition, none of the parking lot drainages are connected to fish-bearing or potentially fish-bearing streams, and the project will provide detention and water quality treatment of parking area runoff to meet the applicable standards. Such techniques include low impact design, bioswales, wet ponds, vaults, or numerous other techniques described in the King County Surface Water Design Manual (King County 1998). Therefore, the project is not expected to have adverse effects on aquatic life in the project area waterways.

Culvert extensions may decrease the efficiency of the drainage system to convey sediment and could also cause an increase in local scour and erosion at the downstream end of the culvert (Whipple et al. 1981). Lengthening culverts can also produce or exacerbate fish migration barriers. However, culvert modifications on all fish-bearing streams or streams with suitable fish-bearing habitat will be designed to provide full fish passage conditions.

Precipitation contacting animal waste, particularly horse manure, could contaminate runoff and have detrimental impacts on water quality and fish habitat. It may also be a non-point source of nutrients, such as nitrogen and phosphorus, bacteria, and excess minerals (King County 2003a,b; Swinkler and Davies 2003). However, horse manure is not anticipated to result in a measurable increase in nutrients, bacteria, and minerals in the watershed because (1) many of the horses using the Trail will be from other local watersheds and will not constitute a new source of pollutants in the watershed; (2) fences will protect wetlands and streams from direct animal impacts; (3) vegetation located between the Trail and streams, wetlands, and Lake Sammamish will filter nutrients in many locations along the project corridor and thereby protect water quality; and (4) BMPs such as a manure management and pet waste disposal plans will be in place. Vegetated buffers have been shown to remove sediment and nutrients from nonpoint source runoff; therefore, it is likely that any pollutants associated with animal waste will be removed by buffers prior to reaching the receiving water (Lowrance et al. 1984; Lowrance et al. 1985; Johnson and Ryba 1992; Osborne and Kovacic 1993; Daniels and Gilliam 1996; Castelle et al. 1994).

Resource protection includes construction of fences near streams and wetlands. Routine Trail maintenance activities also include the removal of sediment and vegetation from ditches and streams, the annual repair and replacement of one to three culverts (as needed), the repair of gravel and pavement, and vegetation mowing. Although routine maintenance work is scheduled to occur during the summer dry months, emergency maintenance is likely during or following large storms if ditches or culverts fail or are blocked with debris. Ongoing, temporary impacts to water quality due to increased turbidity during maintenance activities are likely, but should lessen as culverts and drainage systems are repaired, replaced, and/or maintained.

The effects of the project on water quantity are primarily related to runoff from the paved or cleared areas, and will gradually increase as portions of the Trail are constructed. However, the overall footprint of the Trail in any one drainage basin is insignificant and unlikely to measurably affect stream flows. The project will result in an increase of about 18.8 acres of impervious surface area along the Trail corridor. Of this total, about 10.8 acres will be effective impervious surface area (directly connected to streams by ditch or pipe). This will result in an increase in surface water runoff in the corridor. However, stormwater management (i.e., dispersion, infiltration, and detention) will minimize potential impacts from the increased runoff. Compared to baseline conditions, the relatively insignificant increases in impervious surface are not expected to have a negative effect on stream banks, channel stability, or increases in erosion.

The King County Manual was used to determine the stormwater management requirements for the project area (King County 2005). Because this manual exempts projects that create less than 5,000 square feet of impervious surface area from flow control, it was assumed that wetlands and streams located in subbasins in which the project will create less than 5,000 square feet of new effective impervious surface would not be impacted by an increase in flow rates or flow volume.

The Trail project will result in at least 5,000 square feet of new impervious surface area over 36 individual subbasins, draining to streams and wetlands in the project area. These subbasins were delineated based on the definition of a threshold discharge area (TDA) (King County 2005). A TDA drains to a single natural discharge location or multiple natural discharge locations that combine within one-quarter mile downstream. All of these subbasins combine within one-quarter mile of the Trail, in Lake Sammamish. However, stormwater management in accordance with the applicable surface water standards, will minimize the potential impacts to the environment due to increases in impervious surface area. It is also expected that stream and drainage conditions will improve in the immediate vicinity of the Trail, where existing culverts will be replaced with properly functioning culverts. The current stormwater management requirements will also minimize or eliminate additional cumulative or secondary impacts of the proposed Trail upgrades.

5.2.3 Effects on Wetlands and Wetland Buffers

The construction-related effects of the Trail project will include temporary clearing of wetland vegetation, changes in hydrology, increased sedimentation from construction area runoff, and permanent loss due to fill. The project will result in about 1.04 acres of wetland fill along the Trail corridor, although constructing retaining walls will minimize the amount of fill or wetland vegetation clearing required for the Trail. Construction impacts will also be minimized by clearly marking or fencing off sensitive habitat areas prior to construction activities to limit any unnecessary disturbance to these areas. Any wetland vegetation disturbed or removed by construction activities will be replanted, according to the planting schedule developed as part of the project permitting process.

Changes in hydrology could occur from the construction of retaining walls that extend below the water table, blocking or rerouting groundwater flow. This could affect the viability of wetland vegetation. Dewatering can also result in changing hydrology, although these effects are expected to be short in duration due to the limited construction activities that require dewatering at any one location.

Although construction activities and vegetation clearing will result in exposing bare soil, potentially resulting in erosion and sediment-laden runoff, the temporary and localized nature of such activities is not expected to result in substantial sedimentation of wetlands and streams along the Trail corridor.

The operational effects of the project will consist of a continuation of the effects occurring during construction. These include the long-term loss of wetland habitat and associated functions due to wetland fill, changes in vegetation due to hydrologic alterations, the loss of wetland buffer habitat, and habitat fragmentation. Routine maintenance activities and vegetation management plans could also result in long-term changes in wetland vegetation. As discussed earlier, the increased impervious surface area in the corridor is not expected to substantially alter the hydrology because of the insignificant and widely dispersed changes in runoff characteristics. The project will result in the loss of about 3.9 acres of wetland buffer due to fill for the Trail. However, the project area buffers typically consist of non-native vegetation, which is currently maintained by King County or adjacent property owners, and therefore provide limited habitat or functional value. The modification of such buffers will not substantially alter wetlands or wetland functions.

5.2.4 Effects on Streams and Stream Buffers

Although the project was designed to avoid and minimize impacts to sensitive areas, some unavoidable impacts to streams and their buffers could occur during construction. Such impacts include instream sedimentation, disturbance of fish during stream diversion and dewatering activities, changes in stream hydrology, spills of hazardous materials (e.g., oil and gasoline), and the removal of riparian buffer vegetation. However, implementing project BMPs will reduce the risks of erosion and minimize the chances of sediment and chemical contaminants from entering the area stream channels. As noted in the wetland analyses, the project is not expected to substantially alter the hydrology of the area, and the use of retaining walls will limit the loss of riparian and stream channel habitat. Conducting all in-water work within the established work windows will also minimize the potential effects of construction activities on fish, including the ESA-listed species.

The project will replace non-fish passable culverts on fish-bearing and potentially fish-bearing streams, with fully fish passable structures. This will improve fish passage conditions in the corridor, and increase available aquatic habitat. While no ESA-listed fish species are known to utilize the streams designated for culvert improvement, increased fish access to the upstream fish habitat in these streams could increase overall production in the basin. Increased production is expected to provide increased prey availability for the ESA-listed fish species, as well as bald eagle.

Of the total area of impacted riparian buffer (130,671 square feet or 3.0 acres), distributed over 34 individual streams, 106,244 square feet (2.33 acres) will occur along known or potential fish-bearing streams (Table 12). The existing riparian conditions along the streams vary, but most of these riparian buffers are already moderately to severely degraded. Dominant riparian vegetation within the project corridor includes Himalayan blackberry, Scot’s broom, reed canarygrass, and horsetail, along with black cottonwood big-leaf maple and red alder trees.

Although clearing vegetation along streams could result in the loss of some instream cover, riparian functions such as large woody debris and organic material recruitment, and regulating stream temperatures through shading will not be substantially affected, because of the limited extent of clearing activities in the immediate stream bank areas. Disturbed vegetation areas, including all mature trees (greater than 6-inch-diameter), will be replanted with native species at a minimum ratio of 1:1. Replacing non-native vegetation with native species is expected to improve overall riparian buffer conditions compared to the existing degraded condition.

Table 12 Riparian Buffer Impacts of the Trail Project on Fish-Bearing or Potentially Fish-Bearing Streams

Stream Name/ Number	Station Number	Fish Use	Buffer Impacts	
			Square Feet	Acres
Unnamed	496+20	Potentially Fish Bearing	19,333	0.44
Bear Creek	617+00	Fish Bearing	11,838	0.27
0143H	496+20 to 500+35	Fish Bearing	11,806	0.27
0143G	522+60	Potentially	10,214	0.23
Unnamed Stream	452+40	Potentially	10,012	0.23
0143J	484+10	Potentially	8,045	0.18
Unnamed Stream	254+20	None	7,353	0.17
George Davis	437+94 & 437+90	Fish Bearing	5,368	0.12
Tributary to 0163	239+00	Potentially	5,059	0.12
Unnamed Stream	169+20 to 169+80	Fish Bearing	4,523	0.10
0143F	525+10	Potentially	3,925	0.09
0143L (north branch)	460+95	Potentially	2,613	0.06
0143L (south branch)	456+90	Potentially	2,582	0.06
0143K	470+50	None	2,209	0.05
Ebright	408+82 & 408+86	Fish Bearing	2,116	0.05
0163	237+45	Fish Bearing	2.097	0.05
Unnamed Stream	446+45	Potentially	1,644	0.04
0143D	536+10	Potentially	1,512	0.03
Many Springs	211+90	Potentially	1,226	0.03
Unnamed Stream	449+50	Potentially	1,206	0.03
Unnamed Stream	354+50	Potentially	658	0.01
Unnamed Stream	313+70 & 314+50	Potentially	481	0.01
		Total	**106,244**	**2.33**

6. IMPACT AVOIDANCE AND MINIMIZATION MEASURES

Potential impacts to streams and wetlands will be avoided or minimized to the extent practicable. Specific avoidance and minimization measures for the project include:

- The project design will minimize the footprint of the pavement and fill slopes through incorporation of appropriate design features (i.e., retaining walls).
- The project will provide stormwater treatment for all new PGIS within the project area.
- Loud construction noise and disturbances (i.e., excavation, pavement cutting, chain saw use) will be avoided during the breeding and wintering periods within 0.5 mile of nesting or roosting habitat, to minimize the occurrence of construction noise greater than about 70 dBA at active nest or documented roost sites.
- Instream construction activities will occur during the summer low-flow period, or the approved WDFW HPA in-water work window, to minimize stream flow diversion impacts, reduce sedimentation, and reduce the chances of encountering listed species.
- All fish exclusion and removal activities will follow NMFS-approved WSDOT protocols for these activities (WSDOT 2001).
- Stream and wetland impact mitigation will replace affected functions and values at an equal or greater rate than provided for by existing conditions, including replanting disturbed areas with native species.
- Appropriate BMPs and conservation measures will be employed to reduce sedimentation and erosion and to minimize the chance of contaminant spills during project construction (see Section 6.2).

6.1 WETLAND, STREAM, AND RIPARIAN BUFFER CONSERVATION MEASURES AND MITIGATION

Avoidance and minimization of wetland and buffer impacts were the primary focus of the preliminary design stage of the project. As a result, of the approximately 15 acres of wetlands in the project corridor area, impacts to approximately 14 acres will be completely avoided. Incorporated features in the project to minimize impacts include:

- Using retaining walls or using a narrower trail cross-section to narrow the Trail footprint where wetlands and streams are crossed,
- Shifting the Trail alignment away from sensitive areas,
- Installing permanent fencing to minimize human and domestic animal access to sensitive areas,
- Limiting staging areas to the locations of the proposed parking areas, to minimize unnecessary ground disturbances along the project corridor,
- Limiting earthwork to the dry season, and
- Utilizing BMPs to reduce direct and indirect impacts.

Wetland, wetland buffer, and riparian buffer conservation and mitigation requirements comply with the comprehensive plans, sensitive area ordinances, and shoreline regulations of King County, and the cities of Issaquah, Redmond and Sammamish, to protect natural resources. These cities have also adopted the *King County Surface Water Design Manua*l (King County 2005), which sets requirements intended to protect surface water resources during construction and operational phases of projects. In addition, these cities and King County have adopted the Bear Creek, East Lake Sammamish, and Issaquah Creek basin plans to establish stricter protection standards and additional mitigation requirements for sensitive water resources within these basins (King County 1990a, 1994a, 1994b). The proposed project will meet these regulatory requirements.

6.2 BEST MANAGEMENT PRACTICES

Appropriate BMPs will be used for temporary stream bypasses and for pollution, sediment, and erosion control during construction. Erosion and sediment control measures may include mulching, matting, and netting; filter fabric fencing; quarry rock entrance mats; sediment traps and ponds; and surface water interceptor swales and ditches. Significant long-term water quality impacts are not expected if erosion control BMPs, stormwater treatment facilities (at the three parking facilities), and spill containment measures are properly implemented, monitored, and maintained during construction. Even with BMPs, however, some temporary short-term water quality impacts for sediment are possible. A TESC plan will be prepared and implemented to minimize and control pollution and erosion from stormwater. Runoff from all new PGIS, which discharges directly to fish-bearing or potentially fish-bearing streams, will be treated for water quality and quantity. Concrete shall be sufficiently cured prior to contact with water to avoid leaching. Fresh concrete will not come in contact with Waters of the State. The use of BMPs should eliminate or reduce any direct impacts to listed species. Specific BMPs that will be implemented during construction are as follows:

- Clearly define construction limits with stakes prior to the beginning of ground-disturbing activities. No disturbance will occur beyond these limits. Temporary construction fencing and silt fencing will be installed around streams, ditches, sensitive habitat, and delineated wetlands.
- Minimize vegetation and soil disturbance to the maximum extent possible.
- Implement construction BMPs to control dust and limit impacts to air quality, including the following:
    - Wet down fill material and dust on site;
    - Minimize ground disturbances;
    - Cover loads and ensure adequate freeboard to prevent soil particles from blowing away during transport;
    - Remove excess dirt, dust, and debris from the Trail; and
    - Revegetate disturbed soil as soon as practicable.
- Implement measures to minimize noise impacts during construction, including the installation and maintenance of sound attenuation devices and mufflers on all construction equipment and vehicles.

- Develop a spill containment plan and require the contractor to maintain the necessary materials on-site prior to and during construction.
- If a leak or spill should occur to Waters of the U.S., all work in that vicinity will cease until the source of the leak is identified and corrected and the contaminants have been removed from the water.
- Any wetland or buffer areas temporarily disturbed during construction will be restored to their original function following construction.
- Equipment that is used for in-water work will be cleaned prior to operations below the ordinary high water mark (OHWM). External oil and grease will be removed, along with dirt and mud. No untreated wash and rinse water will be discharged into local waters or wetlands without appropriate treatment.
- Equipment refueling will be conducted within a designated refueling area away from the shoreline, streams, or any designated wetland areas. Additionally, drip pans will be fitted with absorbent pads and placed under all equipment being fueled.
- All vehicles operated within 150 feet of any stream or waterbody will be inspected daily for fluid leaks before leaving the vehicle staging area. Any leaks detected will be repaired before the vehicle resumes operation.
- Spill control and emergency response plans will be implemented for fueling and concrete activity areas.
- Culvert construction and channel realignment activities will occur during the dry season, and the affected stream will be monitored during culvert replacement/extension and bridge retrofit activities, particularly during storm events, for suspended sediments. If excessive turbidity (as defined by Ecology and WSDOT [1998]) is observed, corrective action will be immediately taken.
- All work will be performed in accordance with the conditions of the Hydraulic Project Approval (HPA) obtained for the project.
- If necessary, water intake structures will have fish screens installed and will be operated and maintained in accordance with NMFS fish screen criteria (NMFS 1996b).
- Vegetation removal will be minimized to the greatest extent possible, and erosion control blankets will be used to assist in the rapid revegetation of sites disturbed by culvert replacement.
- No wet or curing concrete, including washout of equipment, will enter Waters of the State.

7. FEDERALLY LISTED SPECIES IN THE ACTION AREA

A discussion of the applicable life history of listed and proposed fish species is included in Appendix G.

7.1 CHINOOK SALMON

7.1.1 ESA and Stock Status

NMFS recently completed an ESA status review of Chinook salmon (*Oncorhynchus tshawytscha*) populations from Washington, Oregon, Idaho, and California, and defined 15 evolutionarily significant units (ESUs; each considered a species under the ESA) within the region. Naturally spawned spring, summer/fall, and fall Chinook salmon runs from the Puget Sound ESU were considered likely to become endangered in the foreseeable future (Myers et al. 1998). The abundance of Chinook salmon in the Puget Sound ESU has declined substantially from historical levels, and there is concern over the effects of hatchery supplementation on genetic fitness of stocks, as well as severely degraded spawning and rearing habitats throughout the area (Myers et al. 1998). In addition, harvest exploitation rates in excess of 90 percent were estimated to occur on some Puget Sound Chinook salmon stocks. Subsequent to this status review, NMFS issued a ruling in May 1999 listing the Puget Sound ESU as threatened (NMFS 1999a). Primary factors contributing to declines in Chinook salmon in the Puget Sound ESU include habitat blockages, hatchery introgression, urbanization, logging, hydropower development, harvests, and flood control and flood effects (NMFS 1998).

Chinook salmon in the project area are managed as part of the Lake Washington summer/fall Chinook salmon stocks which includes the Lake Washington-Issaquah and Lake Washington-North Lake Washington Tributaries summer/fall Chinook salmon stocks (WDF et al. 1993; WDFW 2002). Most spawning takes place in the Issaquah Creek drainage.

Spawners in Issaquah Creek are believed to be entirely the result of hatchery production, mostly from Issaquah Hatchery. Many more fish return than are needed at the hatchery, and surplus fish are allowed to spawn naturally. Numbers of naturally spawning Chinook have been high and fairly stable, so status is rated Healthy in 2002 (WDFW 2002). Historically, this watershed probably did not have a sustainable population of Chinook salmon.

Available genetic stock identification data indicate that the Issaquah and North Lake Washington tributary stocks are genetically similar (Young and Shaklee 2000). The stock origin is believed to be non-native due to Green River stock transfers to the Lake Sammamish basin since the 1930s (WDF et al. 1993). This non-native stock likely derived from the Soos Creek Hatchery Chinook stock, although other non-local stocks may have also influenced the stock composition because it is now genetically different from the Soos Creek Hatchery population (WDFW 2002).

Based upon carcass counts in the basin from 1986 through 2002, the status of this stock is healthy, with counts ranging from 1,118 to 7,314 for an average of 3,144 per year (WDF et al. 1993; WDFW 2002).

7.1.2 Occurrences of Chinook Salmon in the Project Area

Chinook salmon are known to occur within Lake Sammamish, and Big Bear and Issaquah creeks (WDF et al. 1993), as well as some reports of occurrences in Laughing Jacobs and Pine Lake creeks (King County DNR 2007). Summer/fall Chinook salmon adults migrate into fresh water in August and September (Wydoski and Whitney 1979). Spawn timing begins in late September and peaks in October, similar to other Chinook salmon stocks in south Puget Sound (WDF et al. 1993; WDFW 2002). Juvenile Chinook salmon typically rear in fresh water for a couple months and migrate downstream in the spring. However, in large lake systems such as Lake Sammamish, some individuals may rear in fresh water for longer periods (Buckley 1962; Wydoski and Whitney 1979). Specific Chinook salmon life history studies are lacking from Lake Sammamish or its tributaries, but wild Chinook life history is expected to be similar to that observed in nearby Lake Washington.

Chinook salmon in Lake Washington exhibit an early January emergence of fry in the Cedar River, with some entering the lake very early. Emergence continues through early to mid-March. Most fry begin to enter the lake in mid-May. Emigration from Lake Washington proper occurs principally in May and June, but trails off into early September. Small numbers of wild-origin Chinook salmon are found along the Lake Washington shoreline until larger numbers of hatchery Chinook salmon enter the system. Hatchery Chinook salmon releases from the Issaquah Hatchery and the University of Washington occur about the same time, in the first or second week of May. Most of the hatchery releases migrate relatively quickly to the Chittenden Locks, but some remain in Lake Washington.

Studies in Lake Washington suggest that most juvenile Chinook salmon are typically found in the littoral zone during early February to early June (Fresh 2000 personal communication). However, by mid-June some may be distributed somewhat deeper and offshore, although these fish are difficult to sample. Chinook salmon in Lake Washington may not be migrating until May, but by mid-May are smolting heavily. Most leave the lake by the time surface temperatures reach 16 ^{o} to 17^{o} C (Fresh 2000 personal communication).

The majority of the diet of juvenile Chinook salmon while in fresh water consists of invertebrates. Chinook salmon generally feed on insects in the water column or drifting at the surface (Healey 1991). Chinook salmon probably consume chironomids and other aquatic and terrestrial insects, especially in areas where riparian vegetation is adjacent to the lake shoreline.

Based on the recent life history work from Lake Washington, we presume that some naturally produced Chinook salmon from Issaquah Creek are present along the Lake Sammamish shoreline in the spring. Although undocumented, it is possible that some brief rearing by these juveniles may occur in the mouth areas of some of the streams draining the project right-of-way.

7.1.3 Critical Habitat

On September 2, 2005, NMFS (2005) released its final critical habitat designation for 19 salmon and steelhead ESUs in California and the Northwest. The designation obligates federal agencies to give special consideration to their activities when they take place in designated habitat areas. The nearest critical habitat for Puget Sound Chinook salmon is located in Lake Washington, about 13 miles downstream of the project site. No critical habitat is present in Lake Sammamish or its tributaries.

7.2 BULL TROUT

7.2.1 ESA and Stock Status

In 1998, USFWS completed a determination of the status of bull trout, identifying five distinct population segments (DPSs) in the continental United States (1998a). The Coastal-Puget Sound bull trout DPS is composed of 34 subpopulations (USFWS 1998b, 1999a). USFWS listed bull trout in the Coastal-Puget Sound DPS as threatened under the ESA on November 1, 1999 (USFWS 1999a).

Four life history forms are generally recognized for bull trout, which include resident (non-migratory), adfluvial (lake dwelling), fluvial (migratory stream and river dwelling), and anadromous (saltwater migratory) fish. The Coastal-Puget Sound population segment of bull trout, which includes the Lake Washington and Lake Sammamish basins, is unique because it is thought to contain the only anadromous forms of bull trout within the conterminous United States (USFWS 1998a). The status of the migratory (fluvial, adfluvial, and anadromous) forms are of greatest concern throughout most of their range. The majority of the remaining populations in some areas may be largely composed of resident bull trout (Leary et al. 1991; Williams and Mullan 1992).

Bull trout have a wide but very patchy distribution across their range, even in pristine environments (Rieman and McIntyre 1993). The species has been extirpated from many of the large rivers within its historical range, and exists primarily in isolated headwater populations. The decline of bull trout has been attributed to habitat degradation, blockage of migratory corridors by dams, poor water quality, the introduction of nonnative species, and the effects of past fisheries management practices (USFWS 1998a). The stock status of the population in the Lake Washington Drainage (Cedar-Chester Morse Lake subpopulation) is unknown, although bull trout are rarely observed in Lake Washington and Lake Sammamish (WDFW 1998, 2004a; USFWS 1998b).

7.2.2 Occurrences of Bull Trout in the Project Area

Within the Lake Washington Basin, spawning populations of bull trout and Dolly Varden (native char) occur in Chester Morse Lake in the upper Cedar River Basin, but have not been confirmed in the lower Cedar River, Lake Washington, Lake Sammamish, or their tributaries (WDFW 1998, 2004a). There have been only a few reports of bull trout/Dolly Varden in the Lake Washington Basin. Several large native char (approximately 410 mm long) have been observed passing through the viewing chamber at the Chittenden Locks, but in a 2-year creel survey of Lake Washington only one was identified (Bradbury and Pfeifer 1992; USFWS 1998b).

Little is known about historical distribution and abundance of bull trout in the Sammamish River/Issaquah Creek system. A 1-year survey of Lake Sammamish in 1982-83 reported no char (WDFW 1998). However, two unidentified adult native char were observed in the headwaters of Issaquah Creek in October 1993, and anglers have claimed to have once fished for Dolly Varden” in this system approximately 15 to 20 years ago (Fuerstenburg personal communication *in* USFWS 1998b).

The Sammamish River and Issaquah Creek drainages have been negatively impacted by extensive urbanization and road building and the associated poor water quality (Williams et al. 1975; Ecology 1997). Urbanization in Puget Sound has led to decreased habitat complexity (uniform stream channels and simple non-functional riparian areas), impediments and blockages to fish passage, increased surface runoff (more frequent and severe flooding), and decreased water quality and quantity (USFWS 1998a). Effects from urbanization are concentrated in the lower reaches of rivers within Puget Sound, affecting migratory corridors, spawning habitat, and rearing habitat (USFWS 1998a).

Water temperatures above 59° F are believed to limit bull trout distribution (Fraley and Shepard 1989; Rieman and McIntryre 1993) and this may partially explain why bull trout have generally patchy distribution within a given watershed. Optimal temperatures for bull trout egg development are between 36 and 39° F (Goetz 1989; McPhail and Baxter 1996). The Sammamish River is listed on the 303(d) list (under Section 303(d) of the federal Clean Water Act) because of temperature exceedances. Temperatures exceeding 77°F are lethal to salmon, even when they have been acclimated to unusually high temperatures, while the Sammamish River reach above Bear Creek was found to be as warm as 81°F in late July 1998 (Martz et al. 1999). Such high water temperatures, along with the rare occurrence of bull trout in the water, make it highly unlikely that bull trout would occur in the lower Lake Sammamish Basin through the summer (WDFW 2004a).

7.2.3 Critical Habitat

Critical habitat for the Coastal-Puget Sound bull trout DPS was recently designated by the USFWS, although no critical habitat is designated in the Sammamish River basin (USFWS 2005). The nearest critical habitat for the Coastal-Puget Sound bull trout DPS occurs in Lake Washington, about 13 miles downstream of the project site.

7.3 STEELHEAD

7.3.1 ESA and Stock Status

On May 11, 2007, NMFS determined that the Puget Sound steelhead DPS warranted listing as a threatened species under the ESA (Federal Register Vol. 72, No. 91. 26722-26735). The listing was based on the estimated effects of the following factors on the continued existence of the species: (1) present or future destruction, modification, or curtailment of its habitat or range; (2) over utilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors.

The Lake Washington system supports one native winter steelhead stock but not a summer steelhead stock (WDF et al. 1993; WDFW 2006). A limited hatchery program utilizing the native winter steelhead stock was initiated in 1997 as a supplementation type program to assist in recovery of winter steelhead populations in the north Lake Washington tributaries. The Cedar - Sammamish Watershed winter steelhead stock has recently been characterized as critical, due to a steady decrease in the mid-1980’s (WDF et al. 1993; WDFW, 2006). Recent escapement estimates of this stock have been consistently low (20 to 48) between 2000 and 2004, compared to more than 600 in the late 1980s (WDFW 2006).

7.3.2 Occurrences of Steelhead in the Project Area

Spawning takes place throughout the Lake Washington basin including the Sammamish River and its tributaries, Issaquah Creek, Coal Creek, May Creek, the lower Cedar River and several smaller Lake Washington tributaries WDFW (2006). Winter steelhead spawning occurs from mid-December through early June.

7.3.3 Critical Habitat

Critical habitat has not been designated or proposed for the Puget Sound steelhead DPS.

8. WILDLIFE SPECIES EVALUATIONS

A discussion of the applicable life history of the bald eagle is included in Appendix H.

8.1 BALD EAGLES

8.1.1 ESA Status and Distribution

Bald eagles were first protected by the Bald Eagle Protection Act of 1940, and were later listed as endangered under the ESA of 1973. In 1978 the bald eagle was reclassified as threatened in five states, including Washington. Once numbering between 250,000 and 500,000 in the continental United States, the bald eagle population was reduced by human development and the use of the pesticide dicholo-diphenyl-tricholoroethane (DDT) to a low of about 400 pairs by the early 1960s. With the banning of DDT in 1972 and a number of subsequent recovery efforts, the continental U.S. population of bald eagles has since made a dramatic recovery, and by 1998 breeding pairs numbered approximately 6,000. Because of this recovery, USFWS is delisting bald eagle, although the delisting process is ongoing. Once delisted, bald eagles will continue to be protected under the Bald and Golden Eagle Protection Act.

Recovery has been dramatic in Washington State, where there are now over 600 nesting pairs, with approximately 300 pairs in Puget Sound alone. Bald eagle nesting territories are now found along much of the shorelines of Puget Sound and Lake Washington. Washington State also supports the largest wintering population of bald eagles in the continental U.S. (Eagles nesting in Washington commonly winter in British Columbia and Southeast Alaska where winter runs of salmon occur.) A few thousand birds can be found throughout the state where waterfowl and fish congregate, including along the shorelines of Puget Sound.

8.1.2 Occurrences of Bald Eagles in the Project Area

Bald eagles generally occur along shores of saltwater and fresh water lakes and rivers that support substantial prey densities (generally anadromous fish or waterfowl) (Livingston et al. 1990; Stalmaster 1987). Breeding bald eagles use large trees for nesting that are generally within a mile of water and have an unobstructed view of water (ODFW 1996; Anthony and Isaacs 1989). Both breeding and wintering bald eagles forage over open water and use riparian trees, often cottonwoods, for perching. Nesting activities occur from January 1 through August 15. The USFWS also states that wintering bald eagles may also occur in the project area. Wintering activities overlap a portion of the nesting period, occurring from October 31 through March 31.

The USFWS data indicate that wintering and nesting bald eagles occur within King County. Area residents report observing bald eagles in the vicinity of the wildlife analysis area (Eychaner 1999; Ray 2000), and WDFW (2007) has identified three bald eagle breeding territories in the vicinity. The breeding territory on the south side of Lake Sammamish contains one nest site, which is less than about 0.25 mile from the former railbed, but not within line-of-sight. The site was active from 1998 through 2001 and then again in 2005 (Stofel, pers. comm., 2004; WDFW 2007). The breeding territory on the north side of the lake, which also encompasses a portion of the former railbed, contains a nest in Marymoor Park, about 630 feet from the Trail alignment. Through summer 1999, the eagle pair associated with this territory nested in a cottonwood on the edge of the model airplane field at Marymoor Park. However, this nest tree blew down in the fall/winter 1999. The eagles began using the current nest site in 2000; the tree is within line of site of the Trail alignment. The nest site was also active in 2001, 2003, and 2005, but not monitored in 2002 or 2004 (WDFW 2007). Wintering bald eagles forage along Lake Sammamish and perch in large cottonwood trees in the wildlife analysis area vicinity. In addition to these previously identified nest sites, WDFW (2007) also identified a third active nest site within the project area in 2005. This site is located within about 0.2 mile of the Trail corridor, near Pine Lake Creek in the mid-lake region.

8.1.3 Critical Habitat

Critical habitat has not been designated for bald eagles.

9. EFFECTS DETERMINATIONS FOR LISTED SPECIES

9.1 EFFECTS ANALYSIS FOR CHINOOK SALMON

9.1.1 Direct Effects

It is anticipated that the proposed project **may affect** Chinook salmon for the following reasons:

- Juvenile and adult Chinook salmon are known to occur in the project action area.
- The project could result in the potential change in stream flow conditions and/or increased turbidity.
- Some unavoidable impacts to wetland, wetland buffer, and riparian buffer will occur due to trail widening and construction of stormwater treatment facilities.

However, the proposed project **is not likely to adversely affect** Chinook salmon for the following reasons:

- Juvenile and adult Chinook salmon are likely to occur primarily in Lake Sammamish, North Fork Issaquah and Bear creeks (and possibly Laughing Jacobs and Pine Lake creeks). No in-water work is expected to occur in these areas. The Trail crossings of these streams will only require minor changes to the existing bridges, and upland trail construction activities..
- The in-water work activities within the other tributary streams are primarily limited to culvert replacements, and present a low potential to negatively affect individual Chinook salmon, should they happen to stray into these streams.
- No salmonid spawning or quality rearing habitat will be lost or permanently altered due to the project.
- Water temperatures are expected to limit the use of the project area streams and nearshore areas of Lake Sammamish during the summer in-stream work window. In addition to restrictive lake water temperatures, most Chinook salmon are ocean-type fish (exhibiting limited freshwater rearing), with most migrating to the marine environment in the spring. Therefore, the chance of juvenile Chinook salmon occurring in the project area streams is discountable.
- Sediment delivery from construction activities is expected to be insignificant in volume, and the implementation of appropriate BMPs described in the TESC plan, and adherence to the HPA provisions will result in insignificant impacts to stream habitat and Chinook salmon.

Although, the overall ecological functions of the buffers and wetlands will be compensated for by onsite and/or offsite mitigation within the Lake Sammamish Basin. All mature trees (greater than 6-inch diameter) cleared for the project will be replaced at a minimum ratio of 1:1. All buffer and wetland areas temporarily disturbed by the project will be revegetated with native species. Considering the relatively minor riparian disturbance on each stream and that disturbed areas are generally of only moderate quality, no substantial short-term or long-term effects to stream shading, temperature, large woody debris (LWD) recruitment, litter fall production, or microclimate are expected to result from the proposed project. Therefore, temporal loss of riparian functions will be insignificant and discountable.

9.1.2 Indirect Effects

Indirect effects are those impacts that are caused by the action and occur later in time (after the action is completed) but are still reasonably certain to occur. Examples of indirect effects include changes to ecological systems such as predator/prey relationships, long-term habitat changes, or anticipated changes in human activities including changes in land use.

9.1.2.1 Water Quality and Quantity

Indirect effects on Chinook salmon could include effects to water quality and quantity from additional impervious surfaces. The majority (94 percent) of the new impervious surface area is a non-polluting trail surface, and all new PGIS will include stormwater detention and treatment. The project will maintain the overall water quality and the existing hydrological regime within action area streams. Most of the existing Interim Use Trail surface is effectively impervious, as a result of compaction of the railroad bed and existing trail uses. Therefore, the incremental increase in impervious surface is not expected to substantially add to existing runoff conditions. In addition, the Trail runoff will disperse as sheet flow, into the adjacent gravel and vegetated buffer areas, for infiltration. Compared to existing baseline conditions, water quality and quantity will be maintained, and no adverse affects to Chinook salmon will occur due to project stormwater.

Another potential indirect effect of the project will be the improvement of fish passage conditions on fish-bearing and potential fish-bearing streams, due to the replacement of culverts with fully fish passable structures. The larger replacement culverts will allow easier upstream and downstream migration for any juvenile and adult salmonids, including Chinook salmon, which may be present in these stream reaches.

Because the proposed Trail project consists primarily of upgrading the existing Interim Use Trail, it is not expected to change land use, transportation conditions or induce additional growth in the region. Local comprehensive plans, development regulations, and sensitive areas regulations are established to manage the impacts of such growth through the issuance of building permits. The application for a building permit triggers a project review independent of ESA requirements. Land development actions must pass an environmental review and must meet several local, county, state, and federal regulations to protect environmentally sensitive areas.

9.1.3 Interrelated and Interdependent Activities

Interrelated activities are actions that are part of a larger action and that depend upon that action for their justification. Interdependent activities have no independent utility apart from the proposed action. Interrelated and interdependent activities that could result in direct or indirect effects are those that would not occur "but for" the proposed action.

The primary interrelated and interdependent activities associated with the proposed project involve the staging of equipment and stockpile of materials during project construction. However, the staging and stockpile locations will be located at the proposed parking and restroom facility locations, and outside of sensitive areas (wetlands, streams, and their buffers). There are also no known Chinook salmon streams in the vicinity of these parking and restroom facilities. Therefore, no negative impacts to Chinook salmon or their habitat are expected. No other interrelated or interdependent effects on Chinook salmon are expected from the proposed project because the project is not linked, directly or indirectly, to any other projects in the area.

9.1.4 Effects Determination

Based on the probability, severity or duration of anticipated effects, we conclude that the proposed project **may affect but is not likely to adversely affect** Chinook salmon. The potential short-term impacts to water quality (turbidity) will occur when Chinook salmon are not expected to occur in the action area. In addition, Chinook salmon are not expected to occur in the tributaries where in-water work will occur.

9.2 CHINOOK SALMON CRITICAL HABITAT

The project will have **no effect** on Chinook salmon critical habitat because none occurs in the action area (NMFS 2005).

9.3 EFFECTS ANALYSIS FOR BULL TROUT

9.3.1 Direct and Indirect Effects

The direct and indirect effects for bull trout are very similar to those mentioned above for Chinook salmon. While a self-sustaining population of bull trout currently inhabits the Lake Washington basin in the upper Cedar River, few documented sightings have occurred in Lake Washington or Lake Sammamish (USFWS 1998b; WDFW 2004a). Although there has been at least one observation of bull trout in upper Issaquah Creek, recent surveys have not confirmed their status in the Sammamish River basin (King County 2001). If present, bull trout are most likely rare. Therefore, for this analysis we examined the potential life history strategies of bull trout that might exist in the action area, including resident and migratory forms.

The action area streams generally lack the habitat complexity, water quality, and cold water temperatures required by bull trout. Bull trout cannot reproduce in these streams due to high water temperatures, and no spawning habitat for bull trout is present in the action area. Water temperatures in excess of about 15° C are thought to limit bull trout distribution (Rieman and McIntyre 1993). While the proposed project will involve disturbing soil and vegetation, and will require construction activities within the OHWM of the action area streams, the work will occur during the summer dry season when stream temperatures are high, and river flows are low. The timing restrictions and use of TESC plan BMPs will minimize or eliminate the potential for any effects to bull trout.

Effects of construction on the water resources in the action area will meet water quality standards imposed by state and federal laws (e.g., Clean Water Act 404/401, HPA permit). Implementing the identified conservation measures will substantially reduce the potential for degrading water quality. Even if sediment plumes occurred, they will be insignificant in magnitude and duration. Bull trout will likely avoid the plume in preference of less turbid portions of the lake.

9.3.2 Interrelated and Interdependent Activities

Interrelated activities are actions that are part of a larger action and that depend upon that action for their justification. Interdependent activities have no independent utility apart from the proposed action. Interrelated and interdependent activities that could result in direct or indirect effects are those that will not occur “but for” the proposed action.

As described for Chinook salmon, the primary interrelated and interdependent activities associated with the proposed project involve the staging of equipment and stockpile of materials during project construction. However, the staging and stockpile locations will be located at the proposed parking and restroom facility locations, and outside of sensitive areas (wetlands, streams, and their buffers). Therefore, no negative impacts to bull trout or their habitat are expected. No other interrelated or interdependent effects on bull trout are expected from the proposed project because the project is not linked, directly or indirectly, to any other projects in the area.

9.3.3 Effects Determination

Based on the probability, severity or duration of anticipated effects, we conclude that the proposed project **may affect but is not likely to adversely affect** bull trout because their presence in the action area is expected to be extremely rare. The potential short-term impacts to water quality (turbidity) will occur when bull trout are not expected to occur in the action area, due to overall water temperature conditions.

9.4 BULL TROUT CRITICAL HABITAT

The project will have no effect on bull trout critical habitat, as none occurs in the action area (USFWS 2005).

9.5 EFFECTS ANALYSIS FOR STEELHEAD

9.5.1 Direct and Indirect Effects

The direct and indirect effects for steelhead are very similar to those mentioned above for Chinook salmon, although steelhead rear in freshwater longer than juvenile Chinook salmon and are therefore more likely to occur in the action area during the proposed construction period. As a result, a **may affect, not likely to adversely affect** determination is appropriate. This determination is based on the same direct and indirect effects described above for Chinook salmon (Section 9.1.1 and 9.1.2).

9.5.2 Interrelated and Interdependent Activities

Interrelated activities are actions that are part of a larger action and that depend upon that action for their justification. Interdependent activities have no independent utility apart from the proposed action. Interrelated and interdependent activities that could result in direct or indirect effects are those that will not occur “but for” the proposed action. The primary interrelated and interdependent activities associated with the proposed project involve the staging of equipment and stockpile of materials during project construction. However, the staging and stockpile locations will be located at the proposed parking and restroom facility locations, and also located outside of sensitive areas (wetlands, streams, and their buffers). Therefore, no negative impacts to steelhead or their habitat are expected. No other interrelated or interdependent effects on steelhead are expected from the proposed project because the project is not linked, directly or indirectly, to any other projects in the area.

9.5.3 Effects Determination

Based on the probability, severity or duration of anticipated effects, we conclude that the proposed project **may affect, but is not likely to adversely affect** steelhead. The potential short-term impacts to water quality (turbidity) would occur when steelhead are not expected to occur in the tributaries where in-water work will occur.

9.6 EFFECTS ANALYSIS FOR BALD EAGLES

9.6.1 Direct Effects

Bald eagles require unrestricted views and clear flight paths to open water as part of their foraging habitat (Stalmaster and Newman 1979; Stalmaster 1987; Steenhof et al. 1980). Bald eagles wintering on or near Puget Sound hunt mainly waterfowl, grebes, and coots (Stalmaster 1980, 1983, 1987), and these species are prevalent on Lake Sammamish. They frequently forage from prominent perches that provide open views, and prefer snags and live trees along shorelines and riverbanks. Although Big Bear, Ebright, Pine Lake, Laughing Jacobs, and North Fork Issaquah creeks support anadromous fish species that could be preyed upon by eagles, the narrow width of the waterways, combined with the general presence of a riparian overstory, make it difficult for eagles to access the streams. However, fish holding off the stream mouths prior to spawning, or kelts and moribund spawners drifting back into the lake would potentially be available as prey.

Human activities potentially affect wintering bald eagles through loss of foraging and roosting habitat and through disturbance, either to eagles or their prey. Wintering bald eagles also generally avoid areas of high human activity, especially when more secluded habitat with greater forage resources are available (Stalmaster 1980, 1983).

Trail construction activities may create a temporary disturbance to bald eagles and their prey. Equipment used for the project and noise generated during project activities are potential sources of disturbance. There is already considerable activity in Marymoor Park, Lake Sammamish State Park, and along the east shore of Lake Sammamish. Eagles are currently seen in these high-use areas, indicating the birds are habituated to a relatively high level of human activity.

9.6.2 Nesting Eagles

Increased use of the Trail corridor by recreationists after improvements, could affect bald eagles. However, the nesting territories are close to, and essentially surrounded by, a mixture of commercial and residential development. Nesting eagles are clearly habituated to noise and regular disturbance as evidenced by their nesting next to a model airplane use area in Marymoor Park. Similarly, even with the construction and subsequent use of the Interim Use Trail, an additional nesting pair of eagles nested in the action area in 2005.

The proposed Trail improvements are not expected to generate any additional development or disturbance within 0.25 to 0.5 mile of the eagle nesting sites beyond what is already occurring or permissible under local land use plans and sensitive area ordinances. Construction noise could affect eagles, but nesting eagles in the area are adapted to existing roadway, residential, recreational and pedestrian noises. The existing noise disturbances include relatively heavy boat and jet-ski use of the lake, and residential construction activities throughout the year. Known nest sites are within 0.25 mile of the Trail, but are not all within line-of-sight.

Fish passage and water quality improvements in the salmon-bearing streams as a result of this project may ultimately lead to increased salmon run sizes and a potential increase in the eagle forage base.

Although noise and human disturbance resulting from project construction activities will occur, the proposed project is not likely to adversely affect bald eagles for the following reasons:

- Active bald eagle nests have occurred in the project action area for a number of years, and the local bald eagles are likely habituated to human activities, including auto traffic and emergency vehicle sirens and lights, residential and commercial activities, recreational uses of the lake, as well as pedestrian and bicycle use of the Interim Use Trail. Therefore, short-term noise and human disturbance associated with construction activities is unlikely to affect bald eagle behavior.
- Typical loud construction noises (e.g., tree falling, pile driving, excavation, asphalt paving) will be avoided within 0.5 mile of the three identified bald eagle nest sites during the eagle nesting season (January 1 through August).
- Landscape plans include planting cedar trees or other native evergreen vegetation, which could eventually screen some of the future Trail activities from the nest sites. Deciduous trees currently serve as a screen during the growing season.
- Construction during the dry season will also minimize sediment flow into Lake Sammamish, and therefore minimize adverse effects on fish prey species.
- The improved fish passage conditions in the action area streams might result in a small but insignificant increase in fish prey species in the area.
- No disturbance/removal of breeding or roosting trees, or large lakeside vegetation will occur.
- No bald eagle communal roost sites are identified in the action area.

9.6.3 Indirect Effects

Possible indirect effects to bald eagles include potential disturbance or other impacts to prey species, primarily salmonids. However, disturbance of prey during construction are unlikely to occur as a result of BMP and conservation measures implemented to minimize effects on anadromous and resident salmonids. Other indirect effects associated with potential growth and development issues are discussed in Section 9.1.2.

9.6.4 Interrelated and Interdependent Activities

No effects to bald eagles from interrelated and interdependent activities are expected from the proposed project.

9.6.5 Effects Determination

Based on the above assessment, the project **may affect, but is not likely to adversely affect** bald eagles.

9.7 SUMMARY OF EFFECT DETERMINATIONS

The Checklist for Documenting Environmental and Effects of Proposed Actions(s) on Relevant Indicators is included in Section 4.12 and was used to guide the determination of effect for the proposed action on each fish species. An extensive field survey of the habitat parameters identified in the checklist was not performed in the action area. Rather, the checklist was completed using the best available scientific information for the area and through visual observation of the project vicinity.

An assessment was made for potential direct and indirect impacts resulting from the completion of the proposed Trail project. The project aims to improve safety and traffic flow through the corridor by providing pedestrian, bicycle and equestrian users an alternative to road shoulders, while causing minimal disturbance to sensitive areas. Temporary impacts to any species from construction activities for the proposed project will be minimized or eliminated by utilizing appropriate BMPs, and phasing construction to reduce the amount of disturbed area at any one time.

Based on field work by natural resource specialists, evaluation of the proposed design, review of pertinent literature, and interviews with fish and wildlife authorities, we conclude that the project will result in a **may affect, not likely to adversely affect** determination for Puget Sound Chinook salmon, bull trout, steelhead, and bald eagles. Furthermore, the project will have **no effect** on Chinook salmon and bull trout critical habitat.

Based on the EFH requirements of Pacific Coast salmon species, the potential direct, indirect, and cumulative effects of the construction of the proposed project **may affect, but not adversely affect** EFH for Chinook, coho, and pink salmon.

10. REFERENCES

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APPENDIX A

ESA Species Lists

Endangered Species Act Status of West Coast Salmon & Steelhead

(Updated June 15, 2007)

Species[1]			Current Endangered Species Act Listing Status[2]	ESA Listing Actions Under Review
Sockeye Salmon (*Oncorhynchus nerka*)	1	Snake River	***Endangered***	
	2	Ozette Lake	***Threatened***	
	3	Baker River	*Not Warranted*	
	4	Okanogan River	*Not Warranted*	
	5	Lake Wenatchee	*Not Warranted*	
	6	Quinalt Lake	*Not Warranted*	
	7	Lake Pleasant	*Not Warranted*	
Chinook Salmon (*O. tshawytscha*)	8	Sacramento River Winter-run	***Endangered***	
	9	Upper Columbia River Spring-run	***Endangered***	
	10	Snake River Spring/Summer-run	***Threatened***	
	11	Snake River Fall-run	***Threatened***	
	12	Puget Sound	***Threatened***	
	13	Lower Columbia River	***Threatened***	
	14	Upper Willamette River	***Threatened***	
	15	Central Valley Spring-run	***Threatened***	
	16	California Coastal	***Threatened***	
	17	Central Valley Fall and Late Fall-run	***Species of Concern***	
	18	Upper Klamath-Trinity Rivers	*Not Warranted*	
	19	Oregon Coast	*Not Warranted*	
	20	Washington Coast	*Not Warranted*	
	21	Middle Columbia River spring-run	*Not Warranted*	
	22	Upper Columbia River summer/fall-run	*Not Warranted*	
	23	Southern Oregon and Northern California Coast	*Not Warranted*	
	24	Deschutes River summer/fall-run	*Not Warranted*	
Coho Salmon (*O. kisutch*)	25	Central California Coast	***Endangered***	
	26	Southern Oregon/Northern California	***Threatened***	
	27	Lower Columbia River	***Threatened***	• Critical habitat
	28	Oregon Coast	*Not Warranted*	
	29	Southwest Washington	*Undetermined*	
	30	Puget Sound/Strait of Georgia	***Species of Concern***	
	31	Olympic Peninsula	*Not Warranted*	
Chum Salmon (*O. keta*)	32	Hood Canal Summer-run	***Threatened***	
	33	Columbia River	***Threatened***	
	34	Puget Sound/Strait of Georgia	*Not Warranted*	
	35	Pacific Coast	*Not Warranted*	
Steelhead (*O. mykiss*)	36	Southern California	***Endangered***	
	37	Upper Columbia River	***Endangered***	
	38	Central California Coast	***Threatened***	
	39	South Central California Coast	***Threatened***	
	40	Snake River Basin	***Threatened***	
	41	Lower Columbia River	***Threatened***	
	42	California Central Valley	***Threatened***	
	43	Upper Willamette River	***Threatened***	
	44	Middle Columbia River	***Threatened***	
	45	Northern California	***Threatened***	
	46	Oregon Coast	***Species of Concern***	
	47	Southwest Washington	*Not Warranted*	
	48	Olympic Peninsula	*Not Warranted*	
	49	Puget Sound	*Threatened*	• Critical habitat • Protective regulations
	50	Klamath Mountains Province	*Not Warranted*	
Pink Salmon (*O. gorbuscha*)	51	Even-year	*Not Warranted*	
	52	Odd-year	*Not Warranted*	

1 The ESA defines a "species" to include any distinct population segment of any species of vertebrate fish or wildlife. For Pacific salmon, NOAA Fisheries Service considers an evolutionarily significant unit, or "ESU," a "species" under the ESA. For Pacific steelhead, NOAA Fisheries Service has delineated distinct population segments (DPSs) for consideration as "species" under the ESA.

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN IN WESTERN WASHINGTON AS PREPARED BY THE U.S. FISH AND WILDLIFE SERVICE WESTERN WASHINGTON FISH AND WILDLIFE OFFICE

(Revised December 20, 2005)

KING COUNTY

LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) occur in the county. Wintering activities occur from October 31 through March 31.

There are five bald eagle communal winter night roosts located in the county.

There are two bald eagle wintering concentrations located in the county along the Skykomish-Beckler-Tye Rivers and Foss River.

There are 38 bald eagle nesting territories located in the county. Nesting activities occur from about January 1 through August 15.

Bull trout (*Salvelinus confluentus*) occur in the county.

Canada lynx (*Lynx canadensis*) may occur in the county.

Gray wolves (*Canis lupus*) may occur in the county.

Grizzly bears (*Ursus arctos = U. a. horribilis*) may occur in the county.

Marbled murrelets (*Brachyramphus marmoratus*) occur in the county. Nesting murrelets occur from April 1 through September 15.

Northern spotted owls (*Strix occidentalis caurina*) occur in the county throughout the year.

Major concerns that should be addressed in your Biological Assessment of project impacts to listed species include:

1. Level of use of the project area by listed species.
2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.
3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their

avoidance of the project area.

Arenaria paludicola (marsh sandwort) may occur in the county.

Castilleja levisecta (golden paintbrush) may occur in the county.

Major concerns that should be addressed in a Biological Assessment of listed plant species include:

1. Distribution of taxon in project vicinity.
2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.
3. Changes in hydrology where taxon is found.

DESIGNATED

Critical habitat for the northern spotted owl has been designated in King County.

Critical habitat for the marbled murrelet has been designated in King County.

Critical habitat for the bull trout has been designated in King County.

PROPOSED

None

CANDIDATE

Fisher (*Martes pennanti*) (West Coast distinct population segment)
Yellow-billed cuckoo (*Coccyzus americanus*)

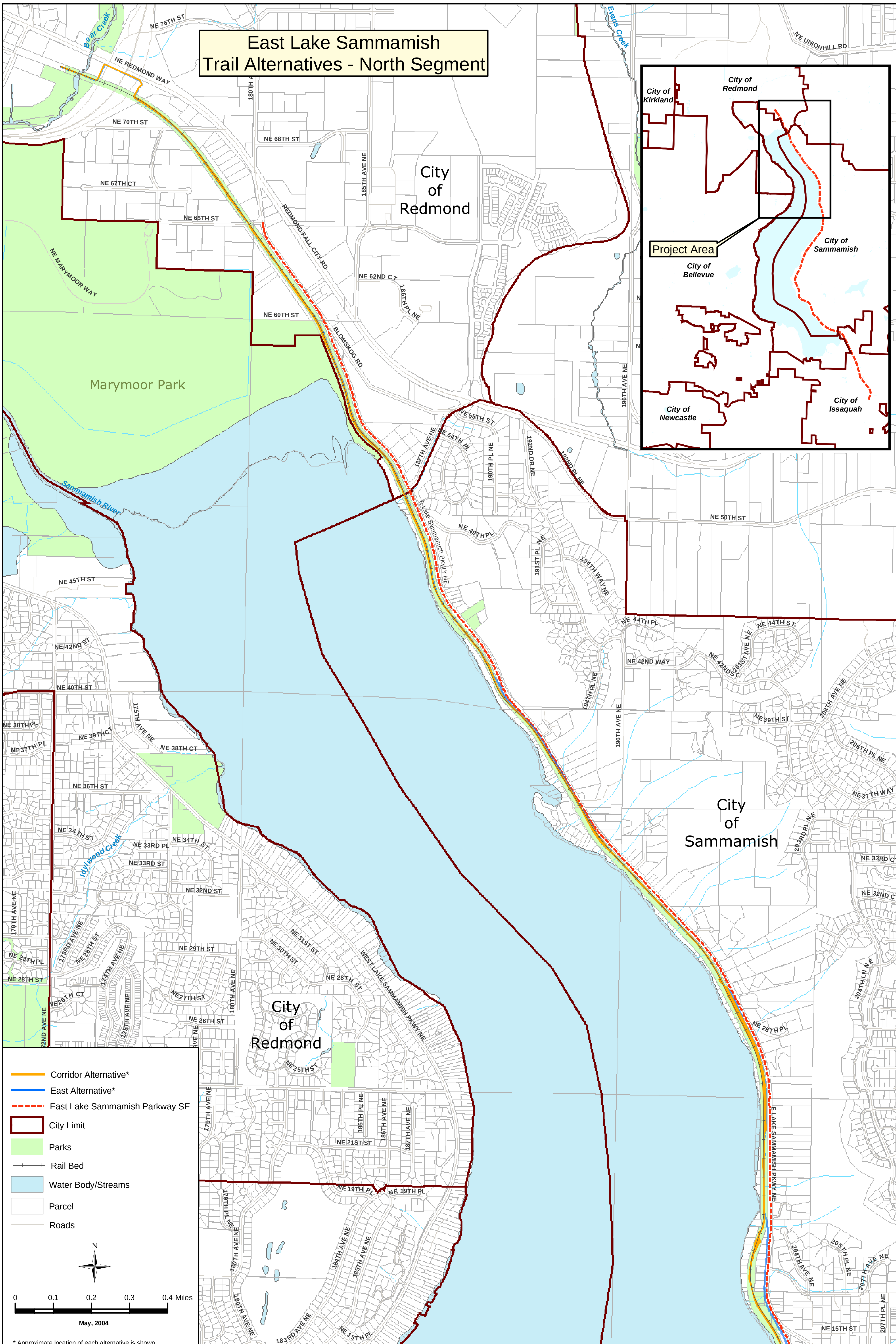
SPECIES OF CONCERN

Beller's ground beetle (*Agonum belleri*)
California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Hatch's click beetle (*Eanus hatchi*)
Larch Mountain salamander (*Plethodon larselli*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Northern sea otter (*Enhydra lutris kenyoni*)
Northwestern pond turtle (*Emys* (= *Clemmys*) *marmorata marmorata*)

Olive-sided flycatcher (*Contopus cooperi*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Tailed frog (*Ascaphus truei*)
Valley silverspot (butterfly) (*Speyeria zerene bremeri*)
Western toad (*Bufo boreas*)
Aster curtus (white-top aster)
Botrychium pedunculosum (stalked moonwort)
Cimicifuga elata (tall bugbane)

APPENDIX B

Proposed Project (Corridor Alternative) Alignment



King County
Department of
Natural Resources and Parks
Wastewater Treatment Division

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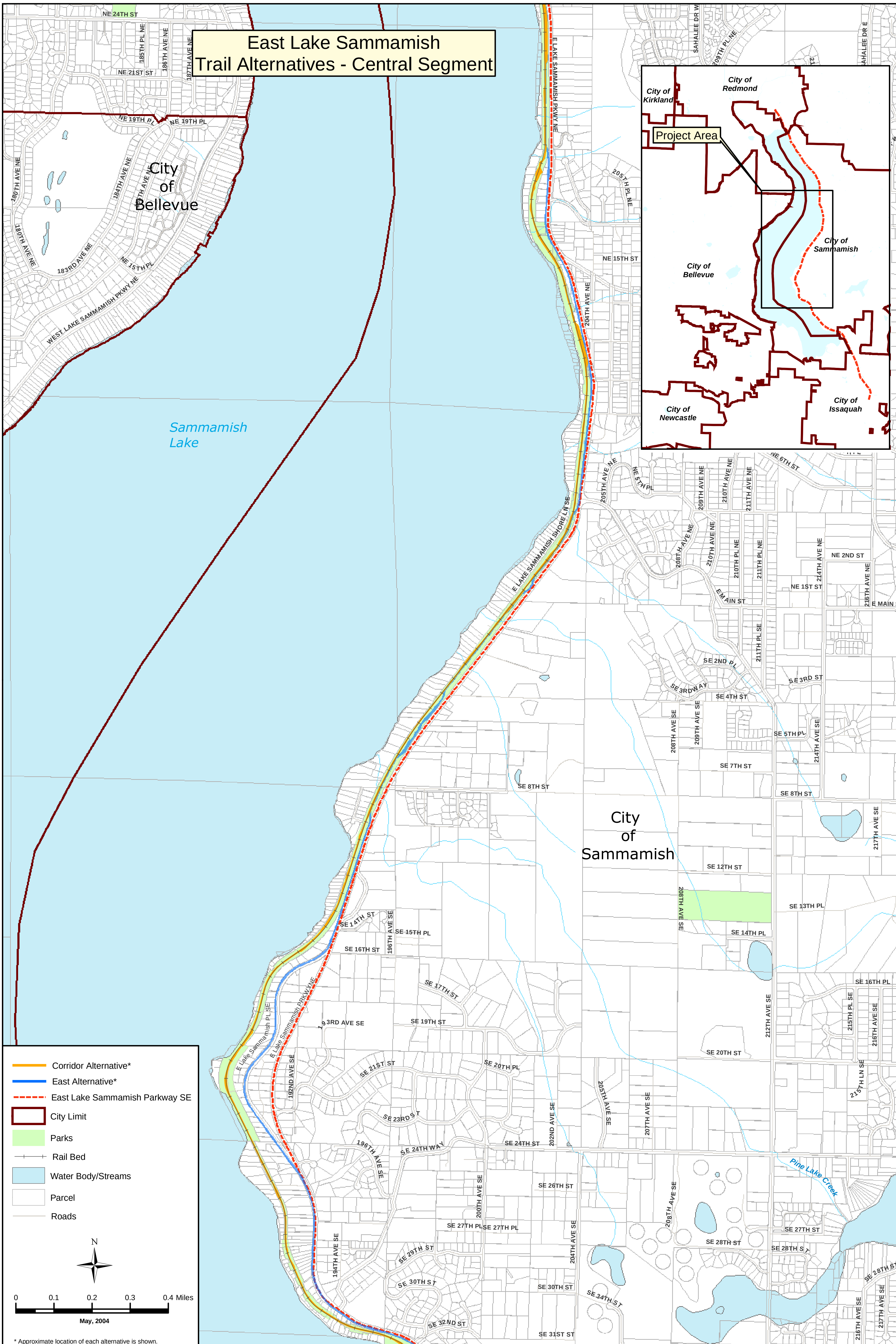
Data Sources: King County GIS, 2003

File Name:L:\ENVIR IMPACTS\2001 projects\21114 ELST Master Plan\gis\PARCELS1.mxd 5/7/2004 cm

Figure 1-A
East Lake Sammamish
Trail Alternatives - North-Segment
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON



King County
Department of
Natural Resources and Parks
Wastewater Treatment
Division

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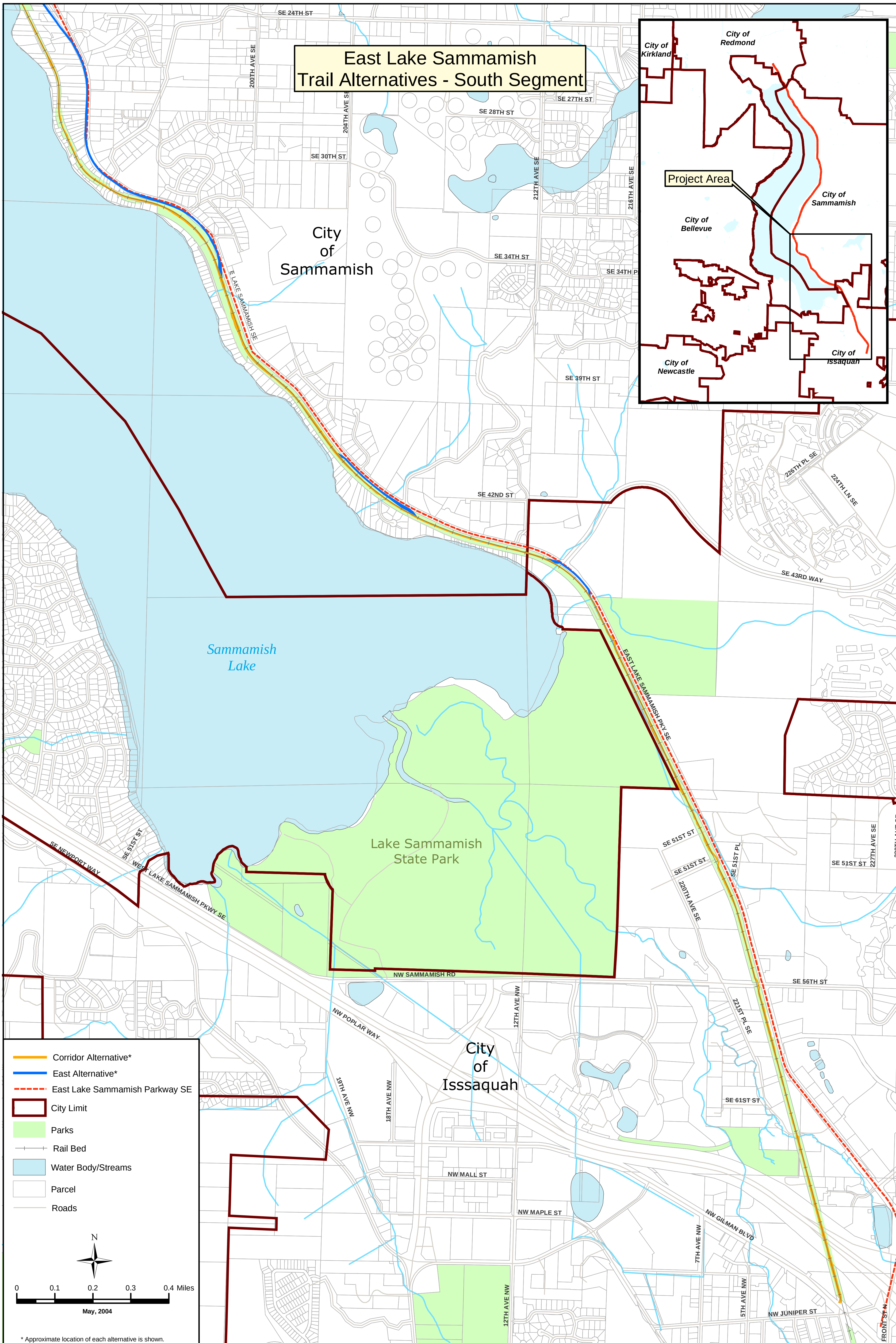
Figure 1-B
East Lake Sammamish
Trail Alternatives - Central-Segment
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON



King County
Department of
Natural Resources and Parks
Wastewater Treatment Division

Data Sources: King County GIS, 2003

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Figure 1-C
East Lake Sammamish
Trail Alternatives - South-Segment
EAST LAKE SAMMAMISH TRAIL MASTER PLAN
KING COUNTY, WASHINGTON

APPENDIX C

Construction Noise Analysis

APPENDIX C

Ambient Terrestrial Noise

The primary source of ambient noise within the majority of the project area is the noise generated by traffic on East Lake Sammamish Parkway. The level of traffic noise depends on the volume of traffic, the speed of the traffic, and the volume of trucks in the flow of traffic (USDOT 1995). Generally, traffic noise levels increase when traffic is heavier or when a greater proportion of the traffic flow is heavy trucks. For traffic volume, 2,000 vehicles per hour sounds twice as loud as (or is 10 dBA higher than) 200 vehicles per hour, and one truck at 55 miles per hour (mph) sounds as loud as 28 cars at 55 mph (USDOT 1995). Vehicle noise is a combination of noises produced by engines, exhaust, and tires. Traffic noise levels can also are affected by the condition and type of roadway, road grade, and the condition and type of vehicle tires. Predictions of noise from vehicles are usually based on reference energy mean emission levels, which correspond to the noise level expected from a single vehicle at the standard 50-foot distance. East Lake Sammamish Parkway is currently a two-lane road with a 35 mph speed limit, through most of the project area. A typical traffic noise level for this roadway type is 82 decibels (dB) (at 50 feet) (WSDOT 2006).

Traffic noise is categorized as line source noise, which spreads cylindrically outward along the length of the roadway. The standard reduction for line source noise is 3 dB per doubling of distance from the source. In contrast, noise from construction equipment is considered point source noise, which spreads spherically over distance. The standard reduction for point source noise is 6 dB per doubling of distance from the source.

In addition to the standard noise reduction factors, several factors affect the sound transmission from a source and the potential noise impact, including frequency of the sound, absorbency of the ground surface, the presence or absence of obstructions, the absorbency or reflectivity of obstructions, and the duration of the sound. For example, a hard site exists where sound travels away from the source over a generally flat, hard surface such as water, concrete, or hard-packed soil. When ground cover or normal unpacked earth (i.e., a soft site) exists between the source and receptor, the ground becomes absorptive to sound energy. Absorptive ground results in an additional noise reduction over distance of 1.5 dB per doubling of distance. Added to the standard reduction rates, point source noise attenuates at a rate of 7.5 dB per doubling of distance, and line source noise decreases at a rate of 4.5 dB per doubling of distance for soft site conditions.

TERRESTRIAL CONSTRUCTION NOISE

The primary noise-generating activities within the action area are those associated with the use of drills, excavation equipment (front end loaders, bulldozers), the operation of pumps and compressors, pavers, chainsaws and vehicle movements typical of a major construction site. In addition, some pile-driving activities could occur during the construction of soldier-pile walls to minimize impacts to sensitive areas. WSDOT (2006) has assembled noise level information from various construction activities at various sites (Table C-1).

TERRESTRIAL NOISE ANALYSIS

Based on the proposed project activities and the construction equipment required, the "worst-case scenario" for noise is for pile driving and chainsaw use (110 A-weighted decibels [dBA\, at 50 feet), for construction of the Trail. Because of the vegetation, houses, and fences immediately adjacent to the Trail, the terrain is considered a soft site; the attenuation factor for this construction noise will be 7.5 dB per doubling of distance, and the traffic noise will attenuate at about 4.5 dB per doubling of distance. The point where construction noise is indistinguishable (above ambient noise) from traffic noise is 12,800 feet from the construction site (Table C-2).

Table C-1. Noise Ranges at 50 Feet from Common Construction Equipment (WSDOT 2006)

Equipment Type	Noise Level dB(A)
Backhoe	72-90
Compressor	73-88
Concrete mixer	75-88
Crane	74-89
Excavator	81-97
Front loader	72-90
Generator	71-82
Grader	79-93
Heavy trucks	82-86
Paver (+ grinder)	85-89
Pumps	68-80
Roller	72-75
Pile driver	81-115
Chainsaw	Avg. 110

Table C-2. Terrestrial Noise Attenuation for East Lake Sammamish Trail Construction Activities

Distance from Noise Source (feet)	Noise from Chain Saw or Pile Driving Equipment (dBA)[a]	Baseline Noise From East Lake Sammamish Parkway Traffic (dBA)[b]
50	110	82
100	102.5	77.5
200	95	73
400	87.5	68.5
800	80	64
1600	72.5	59.5
3,200	65	55
6,400	57.5	51.5
12,800	50	46

[a] assumes residential back ground noise of 50 dBA (WSDOT 2007)

[b] assumes line source noise for a two-lane, 35-40 mph arterial roadway and a 4.5 db reduction per doubling of distance.

Based on the variability of noise for other construction equipment, we assume that project noise may be detected as far as 2.4 miles from the project alignment. However, the detection distance in expected to be much less in the westerly direction (across the lake) because the roadway along the western shoreline of the lake is expected to produce road noise similar to East Lake Sammamish Parkway (about 82 dBA). The shortest distance across the lake from the Trail is about 0.5 miles (2,600 feet), and at that range the loudest Trail-related construction noises will have attenuated to about 68 dBA, which is substantially lower than the road noise along the western shoreline (see Table C-2). Therefore, we assume that construction noises from the Trail will not be detected above background levels past the western shoreline of the lake, making the shoreline of the lake the action area boundary. Similarly, the I-90 highway to the southwest, SR 520 to the northwest, and the Issaquah-Fall City Road to the southeast of the corridor also represent the action area boundaries in these directions.

Based on noise modeling, this is a conservative assessment of the potential distance that construction noise would be detected above ambient noise levels, because the majority of the work will produce noise levels substantially lower than the levels expected for chainsaw or pile driving activities.

Although Table C-2 estimates the extent of the terrestrial action area based on the potential detection range of construction noise, it does not indicate the area that a detected noise will disturb wildlife species. WSDOT (2006) established general guidelines for making effect determinations using threshold distances, based on available literature. This guidance indicates that loud construction activities (including pile driver and jackhammer) will likely result in a ***may affect but is not likely to adversely affect*** determination for bald eagles if it were conducted more than 0.25 mile (0.5 mile if in line of sight) of an active bald eagle use area. Based on this guidance, no loud Trail construction-related activities (pile driving or jackhammer or chainsaw use) will occur within 0.5 mile of an active nest site during the nesting period, or a documented roost site during the wintering period. This threshold distance for these construction activities corresponds to a noise level of about 70 dBA at the nest or roost site (see Table C-2). Using this approximate threshold noise level, the location of other construction activities will also be restricted if they are likely to produce noise levels greater than about 70 dBA at an active nest or roost site during the appropriate season.

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APPENDIX D

Project Area Photos

APPENDIX D
Project Area Photos

Photo D-1. George Davis Creek culvert upstream of the Trail.

Photo D-2. Zaccuse Creek culvert downstream of the Trail.

Photo D-3. Many Springs Creek upstream of the Trail.

Photo D-4. Ebright Creek culvert downstream of the Trail.

Photo D-5. Pine Lake Creek culvert upstream of the Trail.

APPENDIX E

Pathways and Indicators Discussion

APPENDIX E

Pathways and Indicators Discussion

TEMPERATURE

Little information is available for water temperatures in the action area streams. However, temperatures in Lake Sammamish occasionally exceed the state water quality standard of 64°F (18°C) during the summer months (Ecology 2004). Monthly water quality sampling indicated exceedances in mid-July and mid-August from 2003 through 2005. Such temperatures may impair salmonid migration and rearing activities in the reach. Using the matrix of pathways and indicators criteria, the overall baseline condition for temperature is **at risk**. Because much of the new and existing impervious surface within the project area will be non-pollutant generating surface area, and because there will be no significant decreases in overstory riparian vegetation along the existing stream alignments, the project will maintain the baseline conditions for temperature.

SEDIMENT

The action area is characterized by moderate stream gradients, with relatively high sediment loading from upstream disturbance projects. Within the action area, gravel substrate quality has been somewhat affected by human development activities throughout the watershed. Land use activities such as development, agriculture, and forestry have increased the fine sediment (<0.85 mm) loading and reduced the amount suitable spawning gravels, thus likely affecting salmonid spawning success and benthic productivity. Based on the matrix of pathways and indicators criteria, the baseline condition is **at risk**. The project will not increase fine sediments within the action area and will **maintain** baseline conditions.

CHEMICAL CONTAMINANTS/NUTRIENTS

In the vicinity of the existing Interim Use Trail, several streams are 303(d)-listed for chromium, copper, lead, mercury, silver, and zinc (Ecology 2004), however these substances were removed from the 2006 list after further sampling (Ecology 2006). In addition, a listing for fecal coliform has been established for several tributaries within the action area. Urban development upstream in the vicinity of Redmond, Sammamish and Issaquah increases the risk of contamination from non-point source contaminants such as nitrogen, phosphorus, and heavy metals. The East Lake Sammamish Parkway also crosses most of the same tributaries crossed by the Trail, and thereby presenting a source for contaminants in roadway runoff. Based on the matrix of pathways and indicators criteria, baseline conditions for chemical contaminants and nutrients are **not properly functioning**. Because the new impervious surfaces are primarily non-pollutant generating, and the impervious surface area in the proposed parking areas will undergo stormwater treatment, the project is expected to **maintain** baseline conditions.

PHYSICAL BARRIERS

The project will improve fish passage conditions in all fish-bearing and potentially fish-bearing streams in the Trail project area, by replacing existing culverts with full fish passable structures Based on the matrix of pathways and indicators criteria, the baseline conditions are **not properly functioning**. The project will upgrade fish passage by replacing appropriate culverts to full fish passage standards, and will **restore** baseline conditions to these streams.

SUBSTRATE

Gravel substrate quality in the Trail corridor streams and the action area has been affected by human development activities throughout the watershed. Land use activities such as development, agriculture, and forestry have increased the fine sediment (<0.85 mm) loading and reduced the loading of suitable spawning gravels, thus likely affecting salmonid spawning success and benthic productivity. Alterations in hydrology, LWD, and channel characteristics also affect the retention and movement of substrate material. Based on the matrix of pathways and indicators criteria, the baseline condition is **at risk**. The project will not substantially affect substrate quality or quantity in the vicinity and will **maintain** baseline conditions.

LARGE WOODY DEBRIS

Residential development, land clearing, and road and trail maintenance has reduced the potential LWD recruitment to the area streams. Recruitment potential is also impaired in the Trail corridor by the blockage of woody riparian vegetation by upstream culverts, primarily under East Lake Sammamish Parkway. Therefore, current LWD conditions are considered poor in many of these streams. Based on the matrix of pathways and indicators criteria, the baseline condition is **not properly functioning**. The project will not substantially affect the quantity or recruitment of LWD in the area, and will **maintain** baseline conditions.

POOL FREQUENCY

The loss of channel complexity, cover, bank stability, and presence of pools has adversely affected spawning and rearing habitat throughout the Puget Sound lowlands. Channel conditions and complexity have been dramatically altered through most of the area by channelization, loss of LWD and increased sedimentation, and by loss of bank stability and complexity due to a variety of land use practices. LWD presence is critical to creating habitat diversity, cover, and pools and to collecting and retaining sediment. The tributary streams in the project area are typically small and shallow, thereby minimizing the size and function of pools. The NMFS criteria for properly functioning pool frequency in a larger river (>100 feet wide) is 18 pools per mile. Based on the matrix of pathways and indicators criteria, the baseline condition is **at risk**. The project will not substantially affect the hydrology or the recruitment of LWD in the action area, and will therefore **maintain** baseline conditions.

POOL QUALITY

As stated above the relative size of the tributary streams in the project area, and the sediment loading from upstream land use disturbances reduces pool size and quality. Based on the matrix of pathways and indicators criteria, the baseline condition is **at risk**. The project will not substantially affect the stream hydrology or pool quality in the action area, and will therefore **maintain** baseline conditions.

OFF-CHANNEL HABITAT

The size and confinement of the tributary streams in the Trail project area reduce availability of side channels. Therefore the baseline condition is **at risk**. The project will not substantially affect the availability of off-channel habitat areas within the action area, and will **maintain** baseline conditions.

REFUGIA

Refuge habitat capable of supporting and maintaining all life stages of salmonids does not occur in most of the tributaries in the action area. Aquatic functions which support spawning, rearing, and migration such as proper stream temperatures, water quality, and substrate conditions are typically not present, and are therefore functioning **at risk**. The proposed project is predicted to **maintain** these baseline conditions since it will not negatively alter instream conditions.

WIDTH/DEPTH RATIO

The wetted width-to-depth ratios in the streams within the action area are generally greater than 12. Based on this condition, the baseline indicator is **not properly functioning**. The project will **maintain** current width-to-depth ratios since the channel morphology will not be altered as part of the project.

STREAMBANK CONDITION

In the action area, the streambanks of the tributary streams are relatively stable, and this condition is partially due to the presence of riparian vegetation and the railbed restricting the flow of water through the project area, frequently forcing it to flow laterally along the upstream railbed embankment before reaching the culverts. However, increasing development in the upper watersheds is resulting in flashy stream flows, and increased scouring effects. Therefore the baseline indicator meets the NMFS criteria of **at risk**. The project is not expected to alter streambank stability or contribute to further hardening of the streambanks; therefore existing conditions will be **maintained**.

FLOODPLAIN CONNECTIVITY

Road construction and residential development along the Lake Sammamish shoreline, channel straightening and flow diversions have eliminated much of the connection between the action area streams and their natural floodplains. The isolation, filling and draining of habitat in the floodplain has also had a substantial impact. Floodplain isolation and modifications to accommodate residential development also reduced the quantity of habitat available to juvenile salmonids in small tributaries and is **at risk**. Project effects are anticipated to **maintain** the baseline conditions for floodplain connectivity.

CHANGES IN PEAK FLOWS AND BASEFLOWS

Low summer stream flows adversely impact the amount of rearing habitat and increase summer water temperatures. The amount of urbanization increases the frequency, magnitude and duration of stormwater runoff that adversely impacts salmonid rearing habitat. Extensive forest clearing and upstream development has impacted the hydrologic regime of the area. Therefore, the baseline condition is **at risk** according to NMFS criteria. The proposed project will add to the impervious surface area in the basin, but due to the design of appropriate stormwater facilities, and infiltration of most of the runoff, the project is not expected to result in biologically significant effects on steam baseflows or peak flows in the action area. Therefore, the project will **maintain** current baseline conditions.

INCREASES IN DRAINAGE NETWORK

Human disturbance has reduced natural channel lengths of streams within the action area and the project site. Overall, there has been a moderate increase in drainage network density. The baseline condition is **at risk**, and the project is expected to **maintain** the current baseline conditions.

ROAD DENSITY AND LOCATION

The drainage areas within the action area are a mixture of developed and undeveloped land. Within the action area, high road densities (>5 miles of road per square mile of land) exist throughout much of the watersheds, and particularly in the cities of Redmond, Sammamish and Issaquah. Therefore, existing baseline conditions are **at risk**. The completion of this project will not add new roads, and is not expected to cause a growth in population within the action area. Project effects are anticipated to **maintain** the baseline conditions.

DISTURBANCE REGIME

Substantial disturbance has occurred in the project area, due to extensive residential development along the lake and adjacent to the Trail. Natural processes (sediment, LWD, and hydrology regimes) are mainly at risk or not properly functioning. There is also a limited amount of watershed complexity within the action area, and the use of the area by salmonids is restricted. Based on the matrix of pathways and indicators criteria, the existing baseline conditions are **at risk**. The completion of this project is not expected to substantially affect or disturb unstable areas. Therefore, the project effects will **maintain** these baseline conditions.

RIPARIAN RESERVES

The riparian areas associated with the Interim Use Trail are typically disturbed to varying degrees. After abandonment of rail use, some plant species became re-established, although most of these were weedy, non-native, annual species. Other prominent species include weedy woody plants such as Himalayan blackberry and Scots broom. In addition to the disturbances resulting from the construction of the Interim Use Trail, similar disturbance history is associated with the East Lake Sammamish Parkway.

The project area passes through four main cover types: urban matrix, upland and riparian forest (deciduous trees), upland forest (coniferous trees), and wetlands. Thirty-five wetlands or wetland complexes were identified in the project area (KCCFM 2000); most are small, highly disturbed habitats dominated by reed canarygrass. Most of these wetlands are associated with streams and other water conveyance channels, and as a result constitute the dominant riparian conditions in the area. Existing disturbances to these wetlands were typically associated with authorized and unauthorized private uses of the publicly owned right-of-way, including yard waste dumping, filling, and vegetation removal.

Based on the matrix of pathways and indicators criteria, the overall existing baseline conditions for riparian reserves in the action area are **not properly functioning**. Because the project is not anticipated to result in substantial removal or degradation of riparian vegetation, it is expected to **maintain** these conditions.

APPENDIX F

Cadmium, Lead, Chromium, and PAHs in Stormwater

APPENDIX F

Cadmium, Lead, Chromium, and PAHs in Stormwater

CADMIUM (CD)

Cadmium is a relatively rare, naturally occurring metal. Naturally, its initial route of entry to the environment is often via the atmosphere or through the weathering of rocks, soil and volcanoes. However, these sources are minor compared with anthropogenic sources. Anthropogenic sources associated with the transportation system include lubricants, automobile exhaust, tire wear, galvanized steel, and pesticides. Cadmium is found as Cd2+ in-water (Callahan et al. 1979).

Cadmium particulates that settle on the roadways and parking area from automobiles and dry and wet atmospheric deposition would become part of stormwater runoff. According to past WSDOT National Pollutant Discharge Elimination System (NPDES) reports (http://www.wsdot.wa.gov/enviornment/wqec/docs /2003NPDESReport.pdf) and the International BMP Database (http://www.bmpdatabase.org/), cadmium is rarely detected in stormwater above analytical detection limits. Cadmium that is present in stormwater is found in very low concentrations, and levels from parking areas are expected to be lower than roadways due to limited use.

Cadmium that becomes part of runoff is rapidly adsorbed onto particulate matter (Callahan et al. 1979) and will be filtered or settled out in appropriate types of BMPs, such as those BMPs that filter or settle out solids and uses organic material as a filter or “sink” (i.e., ponds, vegetated swales, ecology embankments). Adsorption increases with pH and the organic content of the soil. Therefore leaching is more apt to occur under acidic conditions in sandy soil (SRC 1999a). Cadmium may also precipitate as the carbonate or be adsorbed by or co-precipitate with hydrous iron, aluminum, and manganese oxides (SRC 1999a). Many plants have the ability to accumulate cadmium, primarily in the roots, but also in the stem and leaves (McCracken 1987). Cadmium does not form volatile compounds in the aquatic environment (Callahan et al. 1979); therefore, volatilization from water is not a significant fate process.

Cadmium that is not removed in a BMP and enters surface water is rapidly adsorbed onto particulate matter and settles out. Studies have shown that cadmium concentrations in bed sediment are at least an order of magnitude higher than in the overlying water (Callahan et al. 1979). The uptake of cadmium by many aquatic invertebrates can be appreciable (McCracken 1987). Cadmium is taken up in fish both from the water and in their diets. However, studies have shown that water is the primary source of uptake, with diet playing a minor role (McCracken 1987). In fish, the gill is a key site for metals uptake, but organs such as the liver and kidney can become susceptible as the contaminant is detoxified and eliminated (Riddell et al. 2005). Riddell et al (2005) determined in a study using an experimental aquatic food web, that exposures of 0.5µg/L Cd can have sublethal effects on brook trout (*S. fontinalis*), but also noted a species-specific cadmium tolerance between test species. Studies comparing the cadmium toxicity in bull trout to current regulatory water quality standards have suggested that the recently revised federal Aquatic Life Criteria value for the protection of aquatic biota will be protective of sensitive ESA-listed species (Hansen et al. 2002). The ALC values are a function of water chemistry and can be found at http://www.epa.gov/waterscience/criteria/aqlife.html.

LEAD (PB)

Lead is the fifth most prevalent commercial metal in the United States. Anthropogenic sources associated with the transportation system include bridge paint, automobile exhaust, tire wear, lubricating oil and grease, and bearing wear. Pb^{2+} is the stable ionic species of lead and readily binds to organic compounds in the natural environment.

Lead particulates that settle on roadways and parking areas from automobiles would become part of stormwater runoff. According to past WSDOT NPDES reports (http://www.wsdot. wa.gov/enviornment/ wqec/docs/2003NPDESReport.pdf) and the International BMP Database (http://www.bmpdatabase.org/), lead is rarely detected in stormwater above analytical detection limits. Lead that is present in stormwater is found in very low concentrations.

Lead that becomes part of runoff is effectively removed from the water column to the sediment by adsorption to organic matter and clay minerals, precipitation as insoluble salt (carbonate, sulfate, or sulfide), and reaction with hydrous iron, aluminum, and manganese oxides (SRC 1999b). Only a small fraction of lead in soil appears to be in-water-soluble form (Khan 1983). In soil, lead is relatively immobile and can persist for long periods of time (USEPA 1979). The efficient fixation of lead by most soils greatly limits the transfer of lead to aquatic systems and also inhibits absorption of lead by plants (Kayser et al. 1982). Lead is tightly bound to most soils with virtually no leaching under most conditions (Zimdane and Hassett 1977). Lead is most available from acidic sandy soils which contain little material capable of binding lead (NRCC 1978). Due to its very low vapor pressure and insolubility, volatilization of lead from soil or water would be negligible (SRC 1999b). BMPs that filter or settle out particulate matter will be effective at removing lead from runoff (i.e., ponds, vegetated swales, etc.).

Lead that is not removed via BMPs and is introduced into the aquatic environment is associated with particulate matter that settles down into the sediments (Botelho 1994). However, biomethylation of lead by benthic microorganisms can lead to its remobilization and reintroduction into the aqueous environment (Schulz-Baldes 1983). It has been demonstrated that Pb^0 and Pb^{2+} can be oxidatively methylated by naturally occurring compounds, resulting in the dissolution of lead already bound to sediment or particulate matter (Craig and Rapsomanikis 1985).

Aquatic biota, both invertebrate and vertebrate, have been shown to bioconcentrate lead at levels greater than are present in-water and sometimes similar to those levels present in sediments. However, the concentration of lead tends to decrease with increasing trophic levels in aquatic systems (USEPA 1979). Lead does not appear to bioconcentrate significantly in fish, but does in some shellfish such as mussels (SRC 1999b). Fish do not appear to accumulate lead as readily as the invertebrate species they may eat (Kayser et al. 1982). Multiple studies (MacDonald et al. 2002; Schwartz et al. 2004) have shown that metal toxicity to aquatic species varies with water chemistry and other environmental factors.

CHROMIUM (CR)

Chromium is a widely distributed metal in the earth’s crust, but is rare in unpolluted waters (SRC 2002). Chromium’s valence states range from Cr^{2-} to Cr^{6+}, but the important valence states of chromium are the trivalent state [Cr(III)] and the hexavalent state [Cr(VI)]. Chromium compounds are stable in the trivalent state; the hexavalent state is the second most stable state. Hexavalent chromium rarely occurs naturally, but is produced from anthropogenic sources. Chromium compounds are released into the atmosphere mainly by anthropogenic sources. Naturally occurring gaseous forms of chromium are rare (Carey 1982). Anthropogenic sources associated with the transportation system include metal plating, moving engine parts, brake lining wear, and combustion of natural gas and oil.

Chromium particulates that settle on the roadway from dry and wet atmospheric deposition would become part of stormwater runoff. A Caltrans runoff characterization study (http://www.dot.ca.gov//hq/env/stormwater/special/newsetup/_pdfs/monitoring/CTSWRT-03-065.pdf) indicates that chromium is a low monitoring priority because the estimated percent exceedence of untreated runoff with California standards is 0.01 percent.

Chromium occurs in soluble and insoluble forms. Most of the soluble chromium is present as Cr(VI), but this generally accounts for only a few percent of the total (Carey 1982). Chromium that becomes part of runoff is generally removed from the water column to the sediment by adsorption (Carey 1982). BMPs that filter or settle out particulate matter may be effective at removing chromium from runoff (i.e., ponds, vegetated swales, etc.).

Adsorption of chromium to sediment varies with water chemistry, but Cr(III) tends to be the most prevalent in sediment, occurring mostly as suspended solids adsorbed onto clay material, organics, or iron oxide present in-water (Carey 1982). Adsorption of Cr(III) increases with pH (Bodek 1988; Fukai 1967). Cr(VI) is water-soluble and a strong oxidant (Carey 1982). In the Columbia River, dissolved Cr(III) generally accounts for only 3 percent of the dissolved chromium, while Cr(VI) accounts for over 90 percent (added by atomic reactor cooling water) (Carey 1982).

As pH decreases, adsorption of Cr(VI) to sediment increases (Saleh et al. 1989). Organic matter in soils reduces Cr(VI) to Cr(III) spontaneously. On the other hand, Cr(III) can oxidize to Cr(VI). However, oxidation of Cr(III) would not be significant in most natural waters because dissolved oxygen by itself in natural waters does not cause any measurable oxidation of Cr(III) to Cr(VI) (Saleh et al. 1989).

Based on the above information, most chromium compounds that are discharged into receiving waters will ultimately be deposited in sediments. Generally, there is little tendency for Cr(III) to accumulate along food chains (NRCC 1976). Bottom-dwelling fish like flounder are known to accumulate Cr(VI) (Calamari et al. 1982); however, chromium is not expected to biomagnify in the aquatic food chain (SRC 2002).

POLYCYCLIC AROMATIC HYDROCARBONS (PAHS)

Polycyclic aromatic hydrocarbons (PAHs) are organic substances made up of carbon and hydrogen atoms grouped into at least two condensed aromatic rings structures. These are divided into two categories: low molecular weight compounds, composed of fewer than four rings, and high molecular weight compounds of four or more rings. Anthropogenic sources associated with the transportation system include automobile exhaust, atmospheric deposition, and creosote-treated products.

PAHs that settle on the roadway from atmospheric deposition would become part of stormwater runoff. However, Caltrans concluded that PAHs were a low monitoring priority because they were either never detected or had an estimated percent exceedence with California standards of <0.01 percent in untreated stormwater (http://www.dot.ca.gov//hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTS W-RT-01-050.pdf).

PAHs that become part of runoff are expected to adsorb to suspended solids and sediment. In general, PAHs with higher molecular weights are almost completely adsorbed onto fine particles and are expected to be immobile in soil. Lower molecular weight PAHs are partially adsorbed and are expected to have slight to no mobility in soil (ATSDR 1995). BMPs that filter or settle out particulate matter may be effective at removing PAHs from the runoff (i.e., ponds, vegetated swales, etc.).

PAHs that are introduced to the aquatic environment via runoff are generally associated with sediment and may accumulate over time. In aquatic environments, low molecular weight PAHs generally biodegrade relatively rapidly. In soil, degradation of PAHs with three rings generally takes weeks to months and is primarily accomplished by action of microorganisms (SRC 2003). Also, PAHs with three rings exist predominately in the vapor phase (WHO 1998; ATSDR 1995).

PAHs with four or more rings are generally resistant to biodegradation (SRC 2003). PAHs with four rings can exist in both vapor and particulate phases, while those with five or more rings exist predominately in the particulate phase (WHO 1998; ATSDR 1995); therefore, volatilization of high molecular weight PAHs is not expected to be an important fate process. PAHs are not expected to volatilize from dry soil surfaces (SRC 2003). Bioaccumulation by aquatic organisms is also greater for higher molecular weight PAHs than for lower molecular weight PAHs (ATSDR 1995).

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APPENDIX G

Listed Species Life Histories

APPENDIX G

Life Histories of Listed Species

CHINOOK SALMON PERTINENT LIFE HISTORY

In general, summer/fall Chinook salmon migrate into freshwater in August and September (Wydoski and Whitney 1979). Spawn timing begins in late September and peaks in October, similar to other Chinook salmon stocks in south Puget Sound (WDF et al. 1993). Adult Chinook typically migrate through the Lake Washington/Lake Sammamish system from August through early October.

After emergence, juvenile Chinook salmon rear in freshwater from a few days to 3 years (Wydoski and Whitney 1979); however, most juvenile Chinook salmon in Puget Sound streams migrate to the marine environment during their first year (Myers et al. 1998). These Chinook are called "ocean-type" due to their short freshwater residence and because they make extensive use of the nearshore marine environment for rearing. Ocean-type Chinook salmon generally migrate downstream in the spring, just months after emerging from the gravel, or during the summer and autumn after a brief period of rearing in freshwater (Healey 1991; Myers et al. 1998). Migrant juvenile Chinook salmon timing is usually in April or May, so there is the potential for some fry or pre-smolts to be moving through Lake Sammamish during the project construction. It is expected that most reach Puget Sound by July, as seen in other Puget Sound systems (Hayman et al. 1996).

Juvenile Chinook salmon that remain in freshwater after emergence may migrate to the ocean any time of year, though most Chinook salmon within a population tend to migrate at similar times and ages (Healey 1991). Migration commonly occurs during the night under the cover of darkness, although some fish may migrate during the day (Healey 1991). Chinook salmon fry tend to migrate along the banks and avoid the high-velocity water near the center (thalweg) of the channel (Healey 1991).

Chinook Salmon Critical Habitat

No critical habitat occurs in the project area. The closest designated critical habitat is located 13 miles downstream of Lake Sammamish, and the project is not expected to have any measurable affect that distant from the Trail corridor.

BULL TROUT PERTINENT LIFE HISTORY

The amphidromous life history form of bull trout is poorly studied (see USFWS 1999a). Unlike strict anadromy, as exhibited by Pacific salmon, amphidromous individuals often return seasonally to freshwater as sub-adults, sometimes for several years, before returning to spawn (Wilson 1997). For bull trout, the amphidromous life history form is unique to the Coastal-Puget Sound population. For many years it was thought that amphidromous char in Washington were Dolly Varden (*Salvelinus malma*) and that freshwater char were bull trout. There is conclusive evidence that amphidromous bull trout populate Puget Sound (Kraemer 1994), and anecdotal evidence suggests these native char were once much more abundant (USFWS 1999a). In Washington State, bull trout and Dolly Varden, two closely related native char species, coexist and are managed as a single species. Separate inventories are not maintained by the WDFW due to the considerable biological similarities in life history and habitat requirements that exist between the two species. Although historical reports of char may have specified either bull trout or Dolly Varden, methodologies for reliably distinguishing between the two have only recently been developed and have not yet been widely applied (WDFW 1998).

Bull trout are considered to be optionally amphidromous, (i.e., the survival of individuals is not dependent upon whether they can migrate to sea), in contrast to obligate anadromous species like pink (*Oncorhynchus gorbuscha*) and chum salmon (*O. keta*) (Pauley 1991). Nonetheless, the amphidromous life history form is important to the long-term persistence of bull trout and their meta-population structure. Amphidromous fish are generally larger and more fecund than their freshwater counterparts, and migratory forms play an important role in facilitating gene flow among subpopulations.

Bull trout are believed to be restricted in their spawning distribution by water temperature. Bull trout spawn in late summer and early fall (Bjornn 1991). Locally, amphidromous forms typically return to fresh water in late summer and fall to spawn in upper tributaries and headwater areas. In the Lake Washington system, all known spawning occurs in the upper portions of the Cedar River. Puget Sound stocks typically initiate spawning in late October or early November as water temperature falls below 7 to 8º C. Spawning habitat almost invariably consists of very clean gravel, often in areas of groundwater upwelling or cold spring inflow (Goetz 1994). Neither of these conditions exists in the action area. Egg incubation temperatures needed for survival have been shown to range from 2 to 4ºC (Willamette National Forest 1989). Bull trout eggs require approximately 100 to 145 days to hatch, followed by an additional 65 to 90 days of yolk sac absorption during alevin incubation. Thus, in-gravel incubation spans more than 6 months. Hatching occurs in winter or late spring, and fry emergence occurs from early April through May (Rieman and McIntyre 1993).

Generally, for their first 1 to 2 years, bull trout juveniles rear near their natal tributary and exhibit a preference for cool water temperatures (Bjornn 1991), although they appear less restricted by temperature than are spawners. Newly emerged bull trout fry are often found in shallow, backwater areas of streams that contain woody debris. Later, or in other habitats lacking woody debris for refugia, fry are bottom dwellers, and may occupy interstitial spaces in the streambed (Brown 1992). Because all known spawning occurs in the upper Cedar River, these habitat requirements are not pertinent in the action area.

Resident forms of bull trout spend their entire lives in small streams, while migratory forms live in tributary streams for several years before migrating to larger rivers (fluvial form) or lakes (adfluvial form). Migratory individuals typically move downstream in the summer and often congregate in large, low-velocity pools to feed (Bjornn 1991). Anadromous bull trout usually remain in fresh water 2 or 3 years before migrating to salt water in spring (Wydoski and Whitney 1979).

Bull trout life histories are plastic (i.e., variable and changeable between generations), and juveniles may develop a life history strategy that differs from their parents. The shift between resident and migratory life forms may depend on environmental conditions. For example, resident forms may increase within a population when survival of migratory forms is low (Rieman and McIntyre 1993). Char are generally longer-lived than salmon, and bull trout up to 12 years old have been identified in Washington (Brown 1992).

Bull Trout Critical Habitat

As with Chinook salmon, the nearest designated critical habitat for bull trout is at least 13 miles downstream of Lake Sammamish, in Lake Washington. Therefore, the project will have not affect of habitat that distant from the Trail corridor.

STEELHEAD PERTINENT LIFE HISTORY

Steelhead are the anadromous form of freshwater resident rainbow or redband *O. mykiss* trout species. The present distribution of steelhead extends from Asia, to Alaska, and south to the U.S. Mexico border (Busby et al 1996; 67 FR 21586, May 1, 2002). Unlike many salmonid species, *O. mykiss* exhibit extremely complex and plastic life-history characteristics, such that their offspring can exhibit different life-history forms from the parental generation. For example, offspring of resident fish may migrate to sea, and offspring of anadromous steelhead may remain in streams as resident fish (Burgner et al. 1992).

Those that are anadromous can spend up to 7 years in fresh water prior to smoltification (the physiological and behavioral changes required for the transition to salt water), and then spend up to 3 years in salt water before returning to fresh water to spawn. However, they typically return to their natal stream to spawn as 4- or 5-year-old fish. Unlike Pacific salmon, steelhead trout are iteroparous or capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying, and those that do are usually females (Busby et al. 1996).

Over their entire range, West Coast steelhead spawning migrations occur throughout the year, with seasonal peaks of migration activity varying by location. However, even in a given river basin there might be more than one seasonal migration peak, typically referred to as winter, spring, summer, or fall steelhead runs. Although there are generally four migration seasons, steelhead are typically divided into two basic reproductive ecotypes (summer and winter), based on the state of sexual maturity at the time they enter fresh water and the duration of spawning migration (Burgner et al. 1992). The summer or stream-maturing type enters fresh water in a sexually immature condition between May and October, and sexually matures in fresh water over several months. In contrast, the winter or ocean-maturing type enters fresh water in a sexually mature condition between November and April, and spawns shortly thereafter. In basins with ecotypes, the summer run generally spawns farther upstream than winter run fish. However, the winter run of steelhead is the predominant run in Puget Sound.

Depending on water temperature, fertilized steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as “alevins.” Following yolk sac absorption, young juveniles or “fry” emerge from the gravel and begin active feeding. As they grow, steelhead move to deeper parts of the stream, establish territories, and change diet from microscopic aquatic organisms to larger organisms such as isopods, amphipods and aquatic and terrestrial insects, primarily associated with the stream bottom (Wydoski and Whitney 1979). Riparian vegetation and submerged cover (logs, rocks and aquatic vegetation) are important for providing cover, food, temperature stability, and protection from predators. As a result, densities of juvenile steelhead are highest in areas containing instream cover (Reiser and Bjornn 1979; Johnson and Kucera 1985).

Steelhead Critical Habitat

There is currently no designated steelhead critical habitat in Puget Sound because the species has not been listed.

BALD EAGLE PERTINENT LIFE HISTORY

Nesting, foraging, and perching habitat for bald eagles is typically associated with water features such as rivers, lakes, and coast shorelines where eagles prey upon fish, waterfowl, and seabirds (Stalmaster 1980, 1983, 1987). During breeding season, eagles establish and maintain territorial boundaries, and breeding birds are rarely found in high numbers. The nesting period occurs from January 1 through August 15. Breeding eagles show strong fidelity to a particular nesting territory, and would prevent other eagles from entering it (Grubb 1980). Territories frequently contain two or more nests, but typically used exclusively by one breeding pair, thereby reducing competition for local food resources. Suitable nesting habitat for bald eagles is typically in mature forests that contain large, dominant trees for nesting, and is in close proximity to aquatic foraging habitat (Anthony and Isaacs 1989). Douglas fir (*Pseudotsuga menziesii*) appears to be the most common tree species used for nesting in forests of western Oregon and Washington. Lack of suitable nesting habitat has been shown to be limiting factor for population growth in some raptors (Newton 1979). Unoccupied nests may indicate that suitable physical habitat attributes are available but that human activity precludes their successful use (Anthony and Isaacs 1989).

Bald eagles may spend nights together in communal roosts, more commonly in winter and extreme weather. Many roosts are traditional sites that are used repeatedly and are typically located in areas where the eagles have protection from the weather and away from human activity (Hansen et al. 1980).

Construction projects can affect bald eagles by creating disturbance or degrading their habitat (Bottorff et al. 1987; Anthony and Isaacs 1989). Disturbance can affect nesting eagles by frightening them from their nest, which may affect nesting success and can even result in desertion of the nest (Stalmaster 1987). Anthony and Isaacs (1989) found that nests that are secluded from human disturbance tend to be more productive than those closer to human activities. Some studies suggest that eagles become habituated to human presence, but this apparently depends upon the level, proximity, and duration of the disturbance (Fraser et al. 1985; Mathisen 1968; Stalmaster and Newman 1979). Foraging eagles can be affected by disturbances that may displace them to less preferred areas (Stalmaster and Newman 1979; Stalmaster 1980).

Habitat degradation can be a consequence of construction projects that involve the removal of nesting, perching, roosting, or foraging habitat. Since eagle nesting and foraging habitat is almost always associated with shorelines, construction and development frequently result in the loss of nesting, perching, and foraging opportunities (Stalmaster 1987). While eagle productivity has been positively correlated with the proximity of the nest to water (Anthony and Isaacs 1989), nests in developed areas tend to be further from shorelines (Fraser et al. 1985).

Bald Eagle Critical Habitat

There is currently no designated steelhead critical habitat in Puget Sound.

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APPENDIX H

Essential Fish Habitat Consultation

APPENDIX H
Essential Fish Habitat

BACKGROUND

Public Law 104-297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act to establish new requirements for Essential Fish Habitat (EFH) descriptions in federal fishery management plans and to require federal agencies to consult with National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH.

The Magnuson-Stevens Act requires all fishery management councils to amend their fishery management plans to describe and identify EFH for each managed fishery. The Pacific Fishery Management Council (PFMC) (1999) has issued such an amendment in the form of Amendment 14 to the Pacific Coast Salmon Plan, and this amendment covers EFH for the Pacific salmon (Chinook salmon, coho salmon, and pink salmon) under NMFS jurisdiction that could potentially be affected by the proposed action.

EFH has been defined for the purposes of the Magnuson-Stevens Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (NMFS 1999). NMFS has further added the following interpretations to clarify this definition:

- “Waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate;
- “Substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities;
- “Necessary” means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; and
- “Spawning, breeding, feeding, or growth to maturity” covers the full life cycle of a species.

EFH for Pacific salmon in freshwater includes all streams, lakes, ponds, wetlands, and other currently viable bodies of fresh water and the substrates within those waterbodies accessible to Pacific salmon. Activities occurring above impassable barriers that are likely to adversely affect EFH below impassable barriers are subject to the consultation provisions of the Magnuson-Stevens Act.

EFH for groundfish and coastal pelagic species includes all waters from the mean high water line along the coasts of Washington, upstream to the extent of saltwater intrusion and seaward to the boundary of the U.S. exclusive economic zone (370.4 km.) (PFMC 1998a and 1998b). Designated EFH for salmonid species in estuarine and marine areas includes nearshore and tidally submerged environments within state territorial water out to the full extent of the exclusive economic zone (370.4 km.) offshore of Washington (PFMC 1999).

The Magnuson-Stevens Act requires consultation for all federal agency actions that may adversely affect EFH. EFH consultation with NMFS is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location. Under Section 305(b)(4) of the Magnuson-Stevens Act, NMFS is required to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH. Wherever possible, NMFS utilizes existing interagency coordination processes to fulfill EFH consultations with federal agencies. For the proposed action, this goal is being met by incorporating EFH consultation into the ESA Section 7 consultation, as represented by this Biological Assessment (BA).

EFH for groundfish and coastal pelagic species does not occur in the proposed action area, and will not be affected by project construction or operation. Therefore, EFH for groundfish and coastal pelagic species in not covered in the consultation. EFH for Pacific salmon may be affected by the proposed project, and is covered.

Pacific Coast Salmon

NMFS has designated EFH for Pacific Coast salmon, including Chinook, coho and pink salmon, in Amendment 14 to the Pacific Coast Salmon Plan (NMFS 2000a). Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside of EFH, such as upstream and upslope activities that may have an adverse effect on EFH. Within the action area, the Bear and Issaquah creeks contain EFH for Chinook, coho, and pink salmon. In addition, a number of the project corridor tributaries contain EFH for coho salmon.

Chapter 3, Section 3.2.5.5 of Amendment 14 (NMFS 2000a) addresses construction/urbanization impacts on salmon habitat. Construction projects can significantly alter land surface, soil, vegetation, and hydrology, and can adversely impact salmon EFH through habitat loss or modification. Among numerous types of non-fishing activities that may affect EFH, should BMPs fail, those applicable to the action area are those that would:

- Alter sediment delivery to, and quantity in, streams and estuaries;
- Alter water flow, quantity, timing, temperature, or chemistry;
- Alter the amount or types of nutrients or prey; and/or
- Discharge pollutants, nutrients, or contaminants.

The use of BMPs during construction will avoid and minimize any potential effects upon salmon EFH. Examples of BMPs (see Section 6), as stated in the NMFS EFH guidance (2000b), include avoiding ground-disturbing activities during the wet season; minimizing the time disturbed lands are left exposed; using erosion prevention and sediment control methods; minimizing vegetation disturbance; maintaining buffers of vegetation around wetlands, streams, and drainage ways; avoiding building activities in areas of steep slopes with highly erodible soils; and using methods such as sediment ponds, sediment traps, or other facilities designed to slow water runoff and trap sediment and nutrients.

Effects analysis for essential fish habitat

The determination of the effects of the proposed project on EFH is made pursuant to Section 305(b)(2) of the Magnuson-Stevens Act. Under this act, federal agencies are required to consult with NMFS regarding any of their actions or proposed actions authorized, funded, or undertaken that may “adversely affect” EFH. “Adverse effect” means any impact which reduces the quality and/or quantity of EFH. This can include direct (e.g., contamination, physical disruption), indirect (e.g., loss of prey, reduction in species’ fecundity), site-specific, and habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Cumulative impacts are incremental impacts, occurring within a watershed or marine ecosystem context that may result from individually minor but collectively significant actions. The assessment of cumulative impacts is intended in a generic sense to examine actions occurring within the watershed or marine ecosystem that adversely affect the ecological structure or function of EFH. The assessment should specifically consider the habitat variables that control or limit a managed species' use of a habitat. It should also consider the effects of all impacts that affect either the quantity or quality of EFH. For any federal action that may adversely affect EFH (except those activities covered by a General Concurrence), federal agencies must provide NMFS with a written assessment of the effects of that action on EFH.

Direct, Indirect, and Cumulative Effects

Potential impacts of culvert extension or replacement activities to Chinook salmon are discussed in Section 9.1 of this BA, and are expected to be similar for other anadromous salmonids occurring in the project area. The implementation of appropriate BMPs (Section 6) will protect Lake Sammamish and its tributaries within the project corridor from water quality effects during project construction. Only an insignificant amount of riparian (stream and wetland) impacts will occur due to the construction of the project. Overall, there will be insignificant direct and indirect effects upon Pacific Coast salmon EFH during project construction, but the proposed conservation measures (i.e., improved fish passage conditions on fish-bearing and potential fish-bearing streams) and project BMPs will limit the scope and scale of the impacts, and no large-scale deleterious effects are expected to occur.

DETERMINATION

Based on the EFH requirements of Pacific Coast salmon species, BMPs, and conservation and mitigation measures proposed as part of the project, the determination is that the project may affect, but not adversely affect EFH for Chinook, coho, and pink salmon.

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